Scientific and Technical Aerospace Reports

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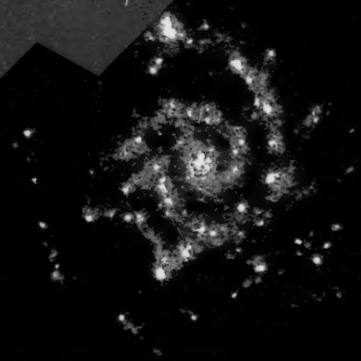

An Abstract Journal

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December 23, 1992
N92-33248 to N92-34247

Scientific and Technical Aerospace Reports

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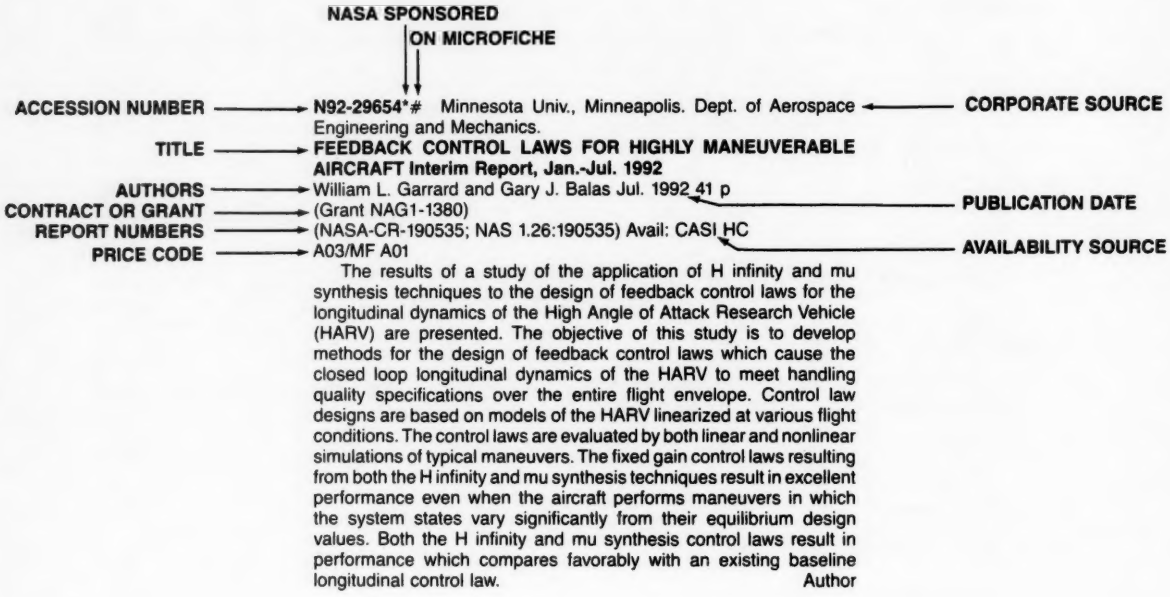
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ACCESSION NUMBER
N92-29654*# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
CORPORATE SOURCE
TITLE
FEEDBACK CONTROL LAWS FOR HIGHLY MANEUVERABLE AIRCRAFT Interim Report, Jan.-Jul. 1992
AUTHORS
William L. Garrard and Gary J. Balas Jul. 1992 41 p
PUBLICATION DATE
CONTRACT OR GRANT
(Grant NAG1-1380)
REPORT NUMBERS
(NASA-CR-190535; NAS 1.26:190535) Avail: CASI HC
AVAILABILITY SOURCE
PRICE CODE
A03/MF A01
The results of a study of the application of H infinity and mu synthesis techniques to the design of feedback control laws for the longitudinal dynamics of the High Angle of Attack Research Vehicle (HARV) are presented. The objective of this study is to develop methods for the design of feedback control laws which cause the closed loop longitudinal dynamics of the HARV to meet handling quality specifications over the entire flight envelope. Control law designs are based on models of the HARV linearized at various flight conditions. The control laws are evaluated by both linear and nonlinear simulations of typical maneuvers. The fixed gain control laws resulting from both the H infinity and mu synthesis techniques result in excellent performance even when the aircraft performs maneuvers in which the system states vary significantly from their equilibrium design values. Both the H infinity and mu synthesis control laws result in performance which compares favorably with an existing baseline longitudinal control law.
Author

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N92-33499# RAND Corp., Santa Monica, CA.
DEVELOPING ROBUST SUPPORT STRUCTURES FOR HIGH-TECHNOLOGY SUBSYSTEMS: THE AH-64 APACHE HELICOPTER
Marc L. Robbins, Morton B. Berman, Douglas W. McIver, William E. Mooz, and John F. Schank 1991 92 p
(Contract MDA903-91-C-0006)
(AD-A252773; RAND/R-3768-A) Avail: CASI HC A05/MF A01

The U.S. Army is relying more and more on high-technology weapons systems, which present a challenge for the logistics structure that must support them. Unlike the simpler weapons systems of the past, today's technologically sophisticated systems have components that are extremely expensive; in addition, maintaining today's systems is far more difficult, because diagnosing and repairing complex subsystem faults require sophisticated and expensive test and diagnostic equipment. And on top of all this, the uncertainties of war make forecasting demands for these expensive items highly problematic. These factors combine in ways that negate the value of preplanned inventory as a way to solve the demands for spares in changing environments. We believe that a more realistic solution to this challenge involves developing and evaluating alternative logistics structures whose more fundable resources-like transportation and repair-are used to respond to changing wartime demands. Using data on the high-technology subsystems of the AH-64 Apache attack helicopter, we hypothesize alternative logistics structures and assess their responsiveness in terms of cost effective improvements to weapon system availability under contingency scenarios. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N92-33304*# Tennessee Univ. Space Inst., Tullahoma.
DYNAMIC INTERACTIONS BETWEEN HYPERSONIC VEHICLE AERODYNAMICS AND PROPULSION SYSTEM PERFORMANCE Final Technical Report, 3 Jan. 1991 - 31 Jul. 1992
G. A. Flandro, R. L. Roach (Georgia Inst. of Tech., Atlanta.), and H. Buschek (Georgia Inst. of Tech., Atlanta.) Jul. 1992 205 p
(Grant NAG1-1205)
(NASA-CR-190638; NAS 1.26:190638) Avail: CASI HC A10/MF A03

Described here is the development of a flexible simulation model for scramjet hypersonic propulsion systems. The primary goal is determination of sensitivity of the thrust vector and other system parameters to angle of attack changes of the vehicle. Such information is crucial in design and analysis of control system performance for hypersonic vehicles. The code is also intended to be a key element in carrying out dynamic interaction studies involving the influence of vehicle vibrations on propulsion system/control system coupling and flight stability. Simple models are employed to represent the various processes comprising the propulsion system. A method of characteristics (MOC) approach is used to solve the forebody and external nozzle flow fields. This results in a very fast computational algorithm capable of carrying out the vast number of simulation computations needed in guidance, stability, and control studies. The three-dimensional fore- and aft body (nozzle) geometry is characterized by the centerline profiles as represented by a series of coordinate points and body cross-section curvature. The engine module geometry is represented by an adjustable vertical grid to accommodate variations of the field parameters throughout the inlet and combustor. The scramjet inlet is modeled as a two-dimensional supersonic flow containing adjustable sidewall wedges and multiple fuel injection struts. The inlet geometry including the sidewall wedge angles, the number of injection struts, their sweepback relative to the vehicle reference line, and strut cross-section are user selectable. Combustion is currently represented by a Rayleigh line calculation including corrections for variable gas properties; improved models are being developed for this important element of the propulsion flow field. The program generates (1) variation of thrust magnitude and direction with angle of attack, (2) pitching moment and line of action of the thrust vector, (3) pressure and temperature distributions throughout the system, and (4) performance parameters such as thrust coefficient, specific impulse, mass flow rates, and equivalence ratio. Preliminary results are in good agreement with available performance data for systems resembling the NASP vehicle configuration. Author

N92-33306*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ON THE ANOMALIES IN SINGLE-JET HOVER SUCKDOWN DATA
Richard E. Kuhn (STO-VL Technology, San Diego, CA.), David C. Bellavia, Douglas A. Wardwell, and Victor R. Corsiglia Aug. 1991 42 p
(RTOP 505-61-71)
(NASA-TM-102261; A-90021; NAS 1.15:102261) Avail: CASI HC A03/MF A01

The data from nine different investigations of the suckdown induced in ground effect by a single jet issuing from plates of various sizes and shapes have been examined and compared. The results show that the generally accepted method for estimating suckdown significantly underestimated the suckdown for most of the configurations. The study identified several factors that could contribute to the differences. These include ground board size, plate edge effects, jet flow quality, jet impingement angle, the size of the chamber in which the tests were run, and obstructions in the region above the model. Most of these factors have not been investigated and in many cases items such as the size of the test chamber, jet flow quality, ground board size, etc., have not even been shown in the documents reporting the investigation. A program to investigate the effects of these factors is recommended. Author

N92-33413*# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
PERSPECTIVES ON HYPERSONIC VISCOUS AND NONEQUILIBRIUM FLOW RESEARCH

H. K. Cheng Aug. 1992 49 p
(Grants NAGw-1061; AF-AFOSR-0104-91)
(NASA-CR-190817; NAS 1.26:190817; USCAE-151) Avail: CASI HC A03/MF A01

An attempt is made to reflect on current focuses in certain areas of hypersonic flow research by examining recent works and their issues. Aspects of viscous interaction, flow instability, and nonequilibrium aerothermodynamics pertaining to theoretical interest are focused upon. The field is a diverse one, and many exciting works may have either escaped the writer's notice or been abandoned for the sake of space. Students of hypersonic viscous flow must face the transition problems towards the two opposite ends of the Reynolds or Knudsen number range, which represents two regimes where unresolved fluid/gas dynamic problems abound. Central to the hypersonic flow studies is high-temperature physical gas dynamics; here, a number of issues on modelling the intermolecular potentials and inelastic collisions remain the obstacles to quantitative predictions. Research in combustion and scramjet propulsion will certainly be benefitted by advances in turbulent mixing and new computational fluid dynamics (CFD) strategies on multi-scaled complex reactions. Even for the sake of theoretical development, the lack of pertinent experimental data in the right energy and density ranges is believed to be among the major obstacles to progress in aerothermodynamic research for hypersonic flight. To enable laboratory simulation of nonequilibrium effects anticipated for transatmospheric flight, facilities capable of generating high enthalpy flow at density levels higher than in existing laboratories are needed (Hornung 1988). A new free-piston shock tunnel capable of realizing a test-section stagnation temperature of 10(exp 5) at Reynolds number 50 x 10(exp 6)/cm is being completed and preliminary tests has begun (H. Hornung et al. 1992). Another laboratory study worthy of note as well as theoretical support is the nonequilibrium flow experiment of iodine vapor which has low activation energies for vibrational excitation and dissociation, and can be studied in a laboratory with modest resources (Pham-Van-Diep et al. 1992). Author

N92-33424*# MCAT Inst., San Jose, CA.
HIGH SPEED TRANSITION PREDICTION Progress Report
Gediminis Gasperas Sep. 1992 26 p Original contains color illustrations
(Contract NCC2-704)
(NASA-CR-190836; NAS 1.26:190836; MCAT-92-017) Avail: CASI HC A03/MF A01; 3 functional color pages

The main objective of this work period was to develop, acquire and apply state-of-the-art tools for the prediction of transition at high speeds at NASA Ames. Although various stability codes as well as basic state codes were acquired, the development of a new Parabolized Stability Equation (PSE) code was minimal. The time that was initially allocated for development was used on other tasks, in particular for the Leading Edge Suction problem, in acquiring proficiency in various graphics tools, and in applying these tools to evaluate various Navier-Stokes and Euler solutions. The second objective of this work period was to attend the Transition and Turbulence Workshop at NASA Langley in July and August, 1991. A report on the Workshop follows. From July 8, 1991 to August 2, 1991, the author participated in the Transition and Turbulence Workshop at NASA Langley. For purposes of interest here, analysis can be said to consist of solving simplified governing equations by various analytical methods, such as asymptotic methods, or by use of very meager computer resources. From the composition of the various groups at the Workshop, it can be seen that analytical methods are generally more popular in Great Britain than they are in the U.S., possibly due to historical factors and the lack of computer resources. Experimenters at the Workshop were mostly concerned with subsonic flows, and a number of demonstrations were provided, among which were a hot-wire experiment to probe the boundary layer on a rotating disc, a hot-wire rake to map a free shear layer behind a cylinder, and the use of heating strips on a flat plate to control instability waves and consequent transition. A highpoint of the demonstrations was the opportunity to observe the rather noisy 'quiet' supersonic pilot tunnel in operation. Author

N92-33484*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF A DIRECT/ITERATIVE DESIGN METHOD TO COMPLEX TRANSONIC CONFIGURATIONS
Leigh Ann Smith and Richard L. Campbell Sep. 1992 36 p
(RTOP 505-59-10-03)
(NASA-TP-3234; L-16962; NAS 1.60:3234) Avail: CASI HC A03/MF A01

The current study explores the use of an automated direct/iterative design method for the reduction of drag in transport configurations, including configurations with engine nacelles. The method requires the user to choose a proper target-pressure distribution and then develops a corresponding airfoil section. The method can be applied to two-dimensional airfoil sections or to three-dimensional wings. The three cases that are presented show successful application of the method for reducing drag from various sources. The first two cases demonstrate the use of the method to reduce induced drag by designing to an elliptic span-load distribution and to reduce wave drag by decreasing the shock strength for a given lift. In the second case, a body-mounted nacelle is added and the method is successfully used to eliminate increases in wing drag associated with the nacelle addition by designing to an arbitrary pressure distribution as a result of the redesigning of a wing in combination with a given underwing nacelle to clean-wing, target-pressure distributions. These cases illustrate several possible uses of the method for reducing different types of drag. The magnitude of the obtainable drag reduction varies with the constraints of the problem and the configuration to be modified. Author

N92-33581*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
DYNAMIC RESPONSE OF INDUCED PRESSURES, SUCKDOWN, AND TEMPERATURES FOR TWO TANDEM JET STOVL CONFIGURATIONS
Douglas A. Wardwell, Victor R. Corsiglia, and Richard E. Kuhn Jul. 1992 204 p
(RTOP 505-68-32)
(NASA-TM-103934; A-90290; NAS 1.15:103934) Avail: CASI HC A10/MF A03

NASA Ames Research Center has been conducting a program to improve the methods for predicting the jet-induced lift loss (suckdown) and hot gas ingestion on jet Short Takeoff and Vertical Landing (STOVL) aircraft during hover near the ground. As part of that program, small-scale hover tests were conducted to expand the current data base and to improve upon the current empirical methods for predicting jet-induced lift loss and hot gas ingestion (HGI) effects. This report is one of three data reports covering data obtained from hover tests conducted at Lockheed Aeronautical Systems, Rye Canyon Facility. It will include dynamic (time dependent) test data for both lift loss and HGI parameters (height, nozzle temperature, nozzle pressure ratio, and inlet location). The flat plate models tested were tandem jet configurations with three planform variations and variable position side-by-side sucking inlets mounted above the planform. Temperature time lags from 8-15 seconds were observed before the model temperatures stabilize. This was larger than the expected 1.5-second lag calculated from literature. Several possible explanations for the flow temperatures to stabilize may include some, or all, of the following: thermocouple lag, radiation to the model surface, and heat loss to the ground board. Further investigations are required to understand the reasons for this temperature lag. Author

N92-33618*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ON THE ESTIMATION OF JET-INDUCED FOUNTAIN LIFT AND ADDITIONAL SUCKDOWN IN HOVER FOR TWO-JET CONFIGURATIONS Final Report
Richard E. Kuhn (STO-VL Technology, San Diego, CA.), David C. Bellavia, Victor R. Corsiglia, and Douglas A. Wardwell Aug. 1991 53 p
(RTOP 505-61-71)

(NASA-TM-102268; A-90040; NAS 1.15:102268) Avail: CASI HC A04/MF A01

Currently available methods for estimating the net suckdown induced on jet V/STOL aircraft hovering in ground effect are based on a correlation of available force data and are, therefore, limited to configurations similar to those in the data base. Experience with some of these configurations has shown that both the fountain lift and additional suckdown are overestimated but these effects cancel each other for configurations within the data base. For other configurations, these effects may not cancel and the net suckdown could be grossly overestimated or underestimated. Also, present methods do not include the prediction of the pitching moments associated with the suckdown induced in ground effect. An attempt to develop a more logically based method for estimating the fountain lift and suckdown based on the jet-induced pressures is initiated. The analysis is based primarily on the data from a related family of three two-jet configurations (all using the same jet spacing) and limited data from two other two-jet configurations. The current status of the method, which includes expressions for estimating the maximum pressure induced in the fountain regions, and the sizes of the fountain and suckdown regions is presented. Correlating factors are developed to be used with these areas and pressures to estimate the fountain lift, the suckdown, and the related pitching moment increments. Author

N92-33625*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

A NOZZLE INTERNAL PERFORMANCE PREDICTION METHOD

John R. Carlson Oct. 1992 50 p

(RTOP 505-62-30-01)

(NASA-TP-3221; L-16965; NAS 1.60:3221) Avail: CASI HC A03/MF A01

A prediction method was written and incorporated into a three-dimensional Navier-Stokes code (PAB3D) for the calculation of nozzle internal performance. The following quantities are calculated: (1) discharge coefficient; (2) normal, side, and axial thrust ratios; (3) rolling, pitching, and yawing moments; and (4) effective pitch and yaw vector angles. Four different case studies are presented to confirm the applicability of the methodology. Internal and, in most situations, external flow-field regions are required to be modeled. The computed nozzle discharge coefficient matches both the level and the trend of the experimental data within quoted experimental data accuracy (0.5 percent). Moment and force ratios are generally within 1 to 2 percent of the absolute level of experimental data, with the trends of data matched accurately. Author

N92-33631*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

EXPERIMENTAL STUDY OF A GENERIC HIGH-SPEED CIVIL TRANSPORT

Pamela S. Belton and Richard L. Campbell Sep. 1992 115 p

(RTOP 505-59-10-03)

(NASA-TM-4382; L-17046; NAS 1.15:4382) Avail: CASI HC A06/MF A02

An experimental study of generic high-speed civil transport was conducted in the NASA Langley 8-ft Transonic Pressure Tunnel. The data base was obtained for the purpose of assessing the accuracy of various levels of computational analysis. Two models differing only in wingtip geometry were tested with and without flow-through nacelles. The baseline model has a curved or crescent wingtip shape, while the second model has a more conventional straight wingtip shape. The study was conducted at Mach numbers from 0.30 to 1.19. Force data were obtained on both the straight wingtip model and the curved wingtip model. Only the curved wingtip model was instrumented for measuring pressures. Selected longitudinal, lateral, and directional data are presented for both models. Selected pressure distributions for the curved wingtip model are also presented. Author

N92-33656*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

SURVEY AND ANALYSIS OF RESEARCH ON SUPERSONIC DRAG-DUE-TO-LIFT MINIMIZATION WITH RECOMMENDATIONS FOR WING DESIGN

Harry W. Carlson (Lockheed Engineering and Sciences Co., Hampton, VA.) and Michael J. Mann Sep. 1992 158 p

(RTOP 505-68-70-02)

(NASA-TP-3202; L-16963; NAS 1.60:3202) Avail: CASI HC A08/MF A02

A survey of research on drag-due-to-lift minimization at supersonic speeds, including a study of the effectiveness of current design and analysis methods was conducted. The results show that a linearized theory analysis with estimated attainable thrust and vortex force effects can predict with reasonable accuracy the lifting efficiency of flat wings. Significantly better wing performance can be achieved through the use of twist and camber. Although linearized theory methods tend to overestimate the amount of twist and camber required for a given application and provide an overly optimistic performance prediction, these deficiencies can be overcome by implementation of recently developed empirical corrections. Numerous examples of the correlation of experiment and theory are presented to demonstrate the applicability and limitations of linearized theory methods with and without empirical corrections. The use of an Euler code for the estimation of aerodynamic characteristics of a twisted and cambered wing and its application to design by iteration are discussed. Author

N92-33678# Naval Postgraduate School, Monterey, CA.

STATIC AND DYNAMIC FLOW VISUALIZATION STUDIES OF TWO DOUBLE-DELTA WING MODELS AT HIGH ANGLES OF ATTACK M.S. Thesis

Feng-Hsi Li Mar. 1992 107 p

(AD-A252878) Avail: CASI HC A06/MF A02

A water tunnel flow visualization was performed to study the vortex development and bursting phenomena on a baseline double delta wing model and a modified double delta wing model. The primary focus of this study was two-fold: (1) to study the static and dynamic effects or pitch and pitch rate on the vortical flowfield of the individual models; and (2) to compare the vortex breakdown characteristics of these two models under static and dynamic conditions. Results indicate that the vortex burst location moves forward with increasing AOA for both the models relative to the static case, the bursting is delayed during pitch-up motion with the vortex burst lag increasing with the pitch rate. Compared with the baseline model, the small geometry modification at the strake/wing junction of the modified model changes the local flowfield by developing the wing vortex earlier and promoting earlier coiling-up of strake and wing vortices. High angle of attack aerodynamics, effect of static AOA, pitch rate dynamic motion, flow visualization by dye injection, vortex development and bursting,water tunnel studies,effect of fillet, baseline or modified double-delta wing. GRA

N92-33699# Ballistic Research Labs., Aberdeen Proving Ground, MD.

ANALYSIS OF THE FLIGHT PERFORMANCE OF THE 155 mm M864 BASE BURN PROJECTILE

James E. Danberg Apr. 1990 52 p

(DA Proj. 1L1-62618-AH-80)

(BRL-TR-3083) Avail: CASI HC A04/MF A01

An engineering model was developed to compute the flight performance of the M864 base burn projectile. This model includes the coupled performance of the gas generator, effects of injected mass flow on the aerodynamics, and a modified point mass trajectory simulation. The gas generator model is based on measured burn rates and basic fluid dynamics. The discharge rate of the generator is calibrated against laboratory experiments. Effects of spin on burn rate are deduced from comparison of analysis with spin fixture tests. Linear and first order nonlinear effects of mass injection on base pressure are the basis for evaluation of base drag. Navier-Stokes solutions near the base with air injection provide essential data. Correlation equations

predict base pressure as a function of Mach number, injection rate, and propellant gas temperature. Temperature effects on base pressure are a unique feature of the analysis. The base bleed model was applied to an instrumented flight test case with good qualitative agreement. There is disagreement with burnout measurements of four percent at low altitudes and much stronger dependence on elevation than observed in flight. The technique predicted range within four percent. Author

N92-33706*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EFFECT OF AFTERBODY GEOMETRY ON AERODYNAMIC CHARACTERISTICS OF ISOLATED NONAXISYMMETRIC AFTERBODIES AT TRANSONIC MACH NUMBERS
Linda S. Bangert and George T. Carson, Jr. Sep. 1992 265 p (RTOP 505-62-30-01)
(NASA-TP-3236; L-17034; NAS 1.60:3236) Avail: CASI HC A12/MF A03

A parametric study was conducted in the Langley 16-Foot Transonic Tunnel on an isolated nonaxisymmetic fuselage model that simulates a twin-engine fighter. The effects of aft-end closure distribution (top/bottom) nozzle-flap boattail angle versus nozzle-sidewall boattail angle) and afterbody and nozzle corner treatment (sharp or radius) were investigated. Four different closure distributions with three different corner radii were tested. Tests were conducted over a range of Mach numbers from 0.40 to 1.25 and over a range of angles of attack from -3 to 9 degrees. Solid plume simulators were used to simulate the jet exhaust. For a given closure distribution in the range of Mach numbers tested, the sharp-corner nozzles generally had the highest drag, and the 2-in. corner-radius nozzles generally had the lowest drag. The effect of closure distribution on afterbody drag was highly dependent on configuration and flight condition. Author

N92-33837 North Carolina State Univ., Raleigh.
AN APPROXIMATE VISCOUS SHOCK LAYER TECHNIQUE FOR CALCULATING CHEMICALLY REACTING HYPERSONIC FLOWS ABOUT BLUNT-NOSED BODIES Ph.D. Thesis
Foy McNeil Cheatwood 1991 250 p
Avail: Univ. Microfilms Order No. DA9130603

An approximate axisymmetric method was developed which can reliably calculate fully viscous hypersonic flows over blunt-nosed bodies. By substituting Maslen's second order pressure expression for the normal momentum equation, a simplified form of the viscous shock layer (VSL) equations is obtained. This approach can solve both the subsonic and supersonic regions of the shock layer without a starting solution for the shock shape. The approach is applicable to perfect gas, equilibrium, and nonequilibrium flowfields. Since the method is fully viscous, the problems associated with coupling a boundary-layer solution with an inviscid-layer solution are avoided. This procedure is significantly faster than the parabolized Navier-Stokes (PNS) or VSL solvers and would be useful in a preliminary design environment. Problems associated with a previously developed approximate VSL technique are addressed before extending the method to nonequilibrium calculations. Perfect gas (laminar and turbulent), equilibrium, and nonequilibrium solutions were generated for air flows over several analytic body shapes. Surface heat transfer, skin friction, and pressure predictions are comparable to VSL results. In addition, computed heating rates are in good agreement with experimental data. The present technique generates its own shock shape as part of its solution, and therefore could be used to provide more accurate initial shock shapes for higher-order procedures which require starting solutions. Dissert. Abstr.

N92-33839 Ohio State Univ., Columbus.
COMPUTATION AND STABILITY ANALYSIS OF LAMINAR FLOW OVER A BLUNT CONE IN HYPERSONIC FLOW Ph.D. Thesis
Vahid Esfahanian 1991 396 p
Avail: Univ. Microfilms Order No. DA9130471

The computation and stability of laminar flow over a 7 degree half-angle blunt cone at M sub infinity = 8 are investigated. The basic flow is obtained by solving the thin-layer Navier-Stokes equations using the Beam and Warming method. The linear-stability equations are derived in body-fitted orthogonal curvilinear coordinates. The usual asymptotic boundary conditions for the disturbance equations are replaced with linearized Rankine-Hugoniot jump conditions. The disturbance equations are solved using a spectral collocation and 4th-order finite-difference compact method. The results of the present computation are compared to those of the STDS experiment. Dissert. Abstr.

N92-33851 Lehigh Univ., Bethlehem, PA.
UNSTEADY RESPONSE OF THE LEADING-EDGE VORTICES ON A PITCHING DELTA WING Ph.D. Thesis
Charles Lee Magness 1991 205 p
Avail: Univ. Microfilms Order No. DA9129999

The unsteady flow past a delta wing undergoing pitching maneuvers to high angle of attack is investigated. The pitching maneuvers are constant-rate motions between initial and final angles of attack. Pitch-up, pitch-down, and consecutive pitch-up/pitch-down maneuvers are considered for a range of non-dimensional pitch rates of practical interest. The primary focus of this investigation is on two aspects of the instantaneous, unsteady flow: the response of the location of vortex breakdown; and the response of the crossflow velocity field and its interpretation in terms of instantaneous streamlines and vorticity distributions. Vortex breakdown is investigated by flow visualization of its instantaneous location for a variety of pitching maneuvers. The vortex breakdown response can lag substantially the motion of the wing. It is classified into regimes based on angle-of-attack criteria for a stationary wing. Particle image velocimetry (PIV) techniques are employed to study the unsteady flow structure on the pitching delta wing. The first implementation of a high resolution, PIV laser-scanning system for three-dimensional flows allows characterization of the unsteady leading-edge vortex. This PIV technique generates detailed, instantaneous velocity fields over the crossflow plane that in turn provide sectional streamline patterns and vorticity fields. Consideration of the instantaneous streamline patterns reveals a new topological structure of the leading-edge vortex that exists over a wide range of pitch rates. It exhibits an unstable focus, i.e. an outward-spiraling motion, of the leading-edge vortex during pitch-up motion to high angle of attack. This vortex structure is fundamentally different from the classical leading-edge vortex on a stationary wing at low angle-of-attack. These characterizations of the instantaneous structure of the leading-edge vortex, provide a new basis for interpreting and controlling the flow past a delta wing during high angle of attack maneuvers. Dissert. Abstr.

N92-34029 Oregon State Univ., Corvallis.
TURBULENCE-INDUCED LOADS ON A TEETERED ROTOR Ph.D. Thesis
Timothy Lavern Weber 1991 149 p
Avail: Univ. Microfilms Order No. DA9130927

Development of variable speed horizontal axis wind turbines has resulted in a need for an analysis code with a rotor speed degree-of-freedom. This study develops a five degree-of-freedom time domain computer code that evaluates blade and rotor, mean and cyclic loads with nonlinear aerodynamics together with atmospheric turbulence as a forcing function. Verification of the model is made by comparison of loads predictions between ESI-80 wind turbine data and analytical solutions. Results show good agreement for mean and cyclic loads and teeter angle excursions. A single-blade point turbulence simulation model is optimized using a three-blade point turbulence simulation model. The optimum point is the 80 percent radius location, although a multiplying factor is needed to make conservative fatigue cycle predictions of blade bending. ESI-80 start-up and shutdown scenarios are examined, and prediction trends matched ESI-80 data. Three generator models are investigated. Results show that generator torque cycles are reduced and yearly energy capture increased by 24 percent when a variable speed generator is implemented. Dissert. Abstr.

N92-34144*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ANALYSIS OF ICED WINGS
T. Cebeci (California State Univ., Long Beach.), H. H. Chen (California State Univ., Long Beach.), K. Kaups (California State Univ., Long Beach.), S. Schimke (California State Univ., Long Beach.), and J. Shin Jan. 1992 14 p Presented at the 30th Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992; sponsored in part by AIAA Previously announced in IAA as A92-29972
(RTOP 505-68-10)
(NASA-TM-105773; E-7201; NAS 1.15:105773) Avail: CASI HC A03/MF A01

A method for computing ice shapes along the leading edge of a wing and a method for predicting its aerodynamic performance degradation due to icing is described. Ice shapes are computed using an extension of the LEWICE code which was developed for airfoils. The aerodynamic properties of the iced wing are determined with an interactive scheme in which the solutions of the inviscid flow equations are obtained from a panel method and the solutions of the viscous flow equations are obtained from an inverse three-dimensional finite-difference boundary-layer method. A new interaction law is used to couple the inviscid and viscous flow solutions. The application of the LEWICE wing code to the calculation of ice shapes on a MS-317 swept wing shows good agreement with measurements. The interactive boundary-layer method is applied to a tapered ice wing in order to study the effect of icing on the aerodynamic properties of the wing at several angles of attack. Author

N92-34147*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PRESSURE MEASUREMENTS ON A RECTANGULAR WING WITH A NACA0012 AIRFOIL DURING CONVENTIONAL FLUTTER
Jose A. Rivera, Jr., Bryan E. Dansberry, Michael H. Durham, Robert M. Bennett, and Walter A. Silva Jul. 1992 132 p
(RTOP 505-63-50)
(NASA-TM-104211; NAS 1.15:104211) Avail: CASI HC A07/MF A02

The Structural Dynamics Division at NASA LaRC has started a wind tunnel activity referred to as the Benchmark Models Program. The primary objective of the program is to acquire measured dynamic instability and corresponding pressure data that will be useful for developing and evaluating aeroelastic type CFD codes currently in use or under development. The program is a multi-year activity that will involve testing of several different models to investigate various aeroelastic phenomena. The first model consisted of a rigid semispan wing having a rectangular planform and a NACA 0012 airfoil shape which was mounted on a flexible two degree-of-freedom mount system. Two wind-tunnel tests were conducted with the first model. Several dynamic instability boundaries were investigated such as a conventional flutter boundary, a transonic plunge instability region near Mach = 0.90, and stall flutter. In addition, wing surface unsteady pressure data were acquired along two model chords located at the 60 to 95-percent span stations during these instabilities. At this time, only the pressure data for the conventional flutter boundary is presented. The conventional flutter boundary and the wing surface unsteady pressure measurements obtained at the conventional flutter boundary test conditions in pressure coefficient form are presented. Wing surface steady pressure measurements obtained with the model mount system rigidized are also presented. These steady pressure data were acquired at essentially the same dynamic pressure at which conventional flutter had been encountered with the mount system flexible. Author

N92-34172* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
VAPORIZING PARTICLE VELOCIMETER Patent
Leonard M. Weinstein, inventor (to NASA) 6 Oct. 1992 6 p Filed 14 Jun. 1991 Supersedes N91-28135 (29 - 20, p 3280)
(NASA-Case-LAR-14685-1; US-Patent-5,153,665; US-Patent-Appl-SN-718313; US-Patent-Class-356-28; US-Patent-Class-73-861.05; US-Patent-Class-356-318; Int-Patent-Class-G01P-3/36) Avail: US Patent and Trademark Office

A velocimeter measures flow characteristics of a flow traveling through a chamber in a given direction. Tracer particles are entrained in the flow and a source of radiant energy produces an output stream directed transversely to the chamber, having a sufficient intensity to vaporize the particles as they pass through the output stream. Each of the vaporized particles explodes to produce a shock wave and a hot core, and a flow visualization system tracks the motion of the hot cores and shock waves to measure the velocity of each tracer particle and the temperature of the flow around the tracer.
Official Gazette of the U.S. Patent and Trademark Office

N92-34193*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PARAMETRIC INVESTIGATION OF SINGLE-EXPANSION-RAMP NOZZLES AT MACH NUMBERS FROM 0.60 TO 1.20
Francis J. Capone, Richard J. Re, and E. Ann Bare Oct. 1992 276 p
(RTOP 505-62-30-01)
(NASA-TP-3240; L-17067; NAS 1.60:3240) Avail: CASI HC A13/MF A03

An investigation was conducted in the Langley 16-Foot Transonic Tunnel to determine the effects of varying six nozzle geometric parameters on the internal and aeropropulsive performance characteristics of single-expansion-ramp nozzles. This investigation was conducted at Mach numbers from 0.60 to 1.20, nozzle pressure ratios from 1.5 to 12, and angles of attack of 0 deg +/- 6 deg. Maximum aeropropulsive performance at a particular Mach number was highly dependent on the operating nozzle pressure ratio. For example, as the nozzle upper ramp length or angle increased, some nozzles had higher performance at a Mach number of 0.90 because of the nozzle design pressure was the same as the operating pressure ratio. Thus, selection of the various nozzle geometric parameters should be based on the mission requirements of the aircraft. A combination of large upper ramp and large lower flap boattail angles produced greater nozzle drag coefficients at Mach number greater than 0.80, primarily from shock-induced separation on the lower flap of the nozzle. A static conditions, the convergent nozzle had high and nearly constant values of resultant thrust ratio over the entire range of nozzle pressure ratios tested. However, these nozzles had much lower aeropropulsive performance than the convergent-divergent nozzle at Mach number greater than 0.60. Author

N92-34243*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
METHOD OF REDUCING DRAG IN AERODYNAMIC SYSTEMS Patent Application
Frank Hrach, inventor (to NASA) 11 Sep. 1992 10 p
(NASA-Case-LEW-14791-1; NAS 1.71:LEW-14791-1; US-Patent-Appl-SN-943659) Avail: CASI HC A02/MF A01

In the present method, boundary layer thickening is combined with laminar flow control to reduce drag. An aerodynamic body is accelerated enabling a ram turbine on the body to receive air at velocity V sub 0. The discharge air is directed over an aft portion of the aerodynamic body producing boundary layer thickening. The ram turbine also drives a compressor by applying torque to a shaft connected between the ram turbine and the compressor. The compressor sucks in lower boundary layer air through inlets in the shell of the aircraft producing laminar flow control and reducing drag. The discharge from the compressor is expanded in a nozzle to produce thrust. NASA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N92-33249# Naval Research Lab., Washington, DC.
LIGHTNING STRIKE TESTS OF COMPOSITE CONNECTORS Final Report
C. D. Bond, F. J. Campbell, and D. P. Smith 19 Jun. 1992 72 p
(AD-A252281; NRL/MR/4654-92-6986) Avail: CASI HC A04/MF A01

Test results are presented on the lightning strike effects on composite and hybrid type multipin aircraft connectors in comparison with the standard all metal connectors. These tests were performed using a unipolar double exponential long duration pulse recommended by the SAE-AE4L committee at peak current levels of 3 kA, 10 kA, 15 kA, and 20 kA. Such peak current levels might be found in all-composite or partially composite aircraft or in exposed areas of all-metal aircraft. GRA

N92-33288# Dynamics Research Corp., Wilmington, MA. Systems Div.
DEVELOPMENT OF RATING INSTRUMENTS AND PROCEDURES FOR AVIATION MISHAP INVESTIGATION Final Report, Jan. - Sep. 1990
Simon R. Pawlik, Sr., Eugene A. Bronkhorst, and Tina M. Bronkhorst Jun. 1992 86 p
(Contract DAHC35-89-D-0030)
(AD-A253072; ARI-RN-92-47) Avail: CASI HC A05/MF A01

This report summarizes the development of improved techniques, procedures, measures, and reporting methods for identifying and reporting aircrew coordination errors in U.S. Army aviation mishaps. Based on an analysis of historical aviation accident data, researchers identified a number of recurring crew coordination errors that have contributed to rotary wing accidents. The errors were categorized and used, along with a theoretical framework and associated set of rating instruments, to produce a supplemental set of investigation and reporting procedures for U.S. Army aviation mishap investigations. The supplemental investigation and reporting procedures were demonstrated and validated in the field in three Class A aviation mishap investigations conducted during the summer of 1990. Participating research psychologists accompanied the U.S. Army Safety Center Accident Investigation Board to assess and refine the procedures in actual use. GRA

N92-34081# National Transportation Safety Board, Washington, DC.
AIRCRAFT ACCIDENT/INCIDENT SUMMARY REPORT: CONTROLLED FLIGHT INTO TERRAIN BRUNO'S INC., BEECHJET, N25BR, ROME, GEORGIA, 11 DECEMBER 1991
8 Jul. 1992 32 p
(PB92-910404; NTSB/AAR-92/01/SUM) Avail: CASI HC A03/MF A01

The crash of N25BR into mountainous terrain near Rome, Georgia is explained. The safety issues discussed include the policies and procedures in corporate flight operations, the role of the first officer in corporate flight operations, and the use of ground proximity warning systems in FAR Part 91 operations of turbojet-powered airplanes. Author

N92-34105*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
NUMERICAL INVESTIGATION OF THE EFFECTS OF ICING ON FIXED AND ROTARY WING AIRCRAFT Semianual Progress Report, 1 Jan. - 30 Jun. 1992
L. N. Sankar Jul. 1992 22 p
(Grant NAG3-768)
(NASA-CR-190542; NAS 1.26:190542) Avail: CASI HC A03/MF A01

A 2-D multi-element airfoil code was modified to study the effects of icing on the aerodynamic characteristics of high lift systems. In each zone of the flow field, the solver numerically integrates the 2-D compressible Navier-Stokes equations using a time marching scheme. The surface pressure distribution is generated over a GAW 130 airfoil/flap combination for a flap setting of 25 degrees, and an angle of attack equal to 5 degrees, at a freestream Mach number equal to 0.3. A series of calculations were performed to determine the effects of small scale ice build up on the high lift characteristics of this arifoil/flap combination. The appendix summarizes this progress. Joint studies on correlation of a 3-D iced wing code with experimental data reviewed new measured laser Doppler velocimeter data in the separated region behind the leading edge ice shape. A version of the iced wing analysis using the Roe scheme was developed to evaluate the poor correlation between the computed and measured velocities in the separated region. Work on the extension of the wing-alone analysis to wing body configuration began with modifications to the 3-D iced wing analyses to accept externally generated grids and multi-block grids. L.R.R.

N92-34151# Dayton Univ. Research Inst., OH. Structural Integrity Div.
ENGINE BIRD INGESTION EXPERIENCE OF THE BOEING 737 AIRCRAFT: EXPANDED DATA BASE Final Report, Oct. 1986 - Sep. 1989
Peter W. Hovey, Donald A. Skinn, and Joseph J. Wilson Jul. 1992 199 p
(Contract DTFA03-88-C-00024)
(DOT/FAA/CT-91/32; UDR-TR-91-125) Avail: CASI HC A09/MF A03

The Federal Aviation Administration (FAA) Technical Center initiated a study in Oct. 1986 to determine the numbers, weights, and species of birds that are being ingested into medium and large inlet area turbofan engines and to determine what damage, if any, results. Bird ingestion data were collected for the Boeing-737 model aircraft which uses either the Pratt and Whitney JT8D medium inlet area turbofan engine or the CFM International CFM56 large inlet area turbofan engine. This report analyzes the entire 3 years of data collected by the engine manufacturers, the FAA, and the International Civil Aviation Organization (ICAO) during the period from Oct. 1986 through Sep. 1989. Author

N92-34192*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
IMPACTS OF TECHNOLOGY ON THE CAPACITY NEEDS OF THE US NATIONAL AIRSPACE SYSTEM
Raymond A. Ausrotas and Robert W. Simpson Washington Oct. 1992 65 p Sponsored by NASA. Langley Research Center
(Grant NAG1-1149; RTOP 505-69-20-01)
(NASA-CR-4470; NAS 1.26:4470; FTL-R-91-7) Avail: CASI HC A04/MF A01

A review of the U.S. air transportation system is undertaken, focusing on airspace and airport capacity. Causes of delay and congestion are investigated. Aircraft noise is identified as the fundamental hindrance to capacity improvement. Research areas for NASA are suggested to improve capacity through technology. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N92-33308# Federal Aviation Administration, Atlantic City, NJ.
ILS MATHEMATICAL MODELING STUDY OF AN ILS LOCALIZER AND GLIDE SLOPE PROPOSED FOR RUNWAY 32R, MOFFETT FIELD AIRPORT, CALIFORNIA Technical Report, May 1992
James D. Rambone Sep. 1992 29 p
(Contract FAA-T0603-S)
(DOT/FAA/CT-TN92/28) Avail: CASI HC A03/MF A01

Described here is the instrument landing system (ILS) math modeling performed by the Federal Aviation Administration (FAA) Technical Center at the request of the NASA-Ames Research Center Aircraft Operations Division. Computed localizer data are presented showing the effects of three large airship hangars on the performance of an ILS localizer proposed for runaway 32R at the Moffett Field Airport. There is concern that reflections from the large airship hangars may degrade the localizer course beyond Category I tolerances. A 14/6 dual-frequency localizer antenna system, a Redlich system, and a Wilcox 14/10 system (currently under development) were modeled at the proposed localizer site. Modeled course structure results for a 14/6 dual-frequency antenna exceed Category I tolerance limits. Modeled course structure results indicate that Category I localizer performance should be obtained with a Redlich antenna system or a Wilcox 14/10 antenna system installed at the proposed location. Computed clearance orbit results for the Redlich antenna and Wilcox 14/10 system indicate satisfactory linearity, course crossover, and signal clearance levels. Data are also presented showing the computed performance for a glide slope proposed for runaway 32R at Moffett Field Airport. As requested, a capture effect system was modeled at the proposed glide slope site located 1,038 feet back from runaway threshold and 400 feet right offset of centerline. Glide slope modeling computed only the effect of terrain on glide slope performance using the Geometric Theory of Diffraction-3D (GTD-3D) model. Modeled path structure and level run plots are provided for the proposed capture effect system. Results indicate that a capture effect system modeled at the proposed site should meet Category I path structure, linearity, and symmetry tolerances. Author

N92-33407*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
DESIGN AND EVALUATION OF AN ADVANCED AIR-GROUND DATA-LINK SYSTEM FOR AIR TRAFFIC CONTROL
Wim denBraven Jan. 1992 40 p Original contains color illustrations
(RTOP 505-64-13)
(NASA-TM-103899; A-92003; NAS 1.15:103899) Avail: CASI HC A03/MF A01; 1 functional color page

The design and evaluation of the ground-based portion of an air-ground data-link system for air traffic control (ATC) are described. The system was developed to support the 4D Aircraft/ATC Integration Study, a joint simulation experiment conducted at NASA's Ames and Langley Research Centers. The experiment focused on airborne and ground-based procedures for handling aircraft equipped with a 4D-Flight Management System (FMS) and the system requirements needed to ensure conflict-free traffic flow. The Center/TRACON Automation System (CTAS) at Ames was used for the ATC part of the experiment, and the 4D-FMS-equipped aircraft was simulated by the Transport Systems Research Vehicle (TSRV) simulator at Langley. The data-link system supported not only conventional ATC communications, but also the communications needed to accommodate the 4D-FMS capabilities of advanced aircraft. Of great significance was the synergism gained from integrating the data link with CTAS. Information transmitted via the data link was used to improve the monitoring and analysis capability of CTAS without increasing controller input workload. Conversely, CTAS was used to anticipate and create prototype messages, thus reducing the workload associated with the manual creation of data-link messages. Author

N92-33596# Federal Aviation Administration, Cambridge, MA. National Transportation Systems Center.
CONTROLLER RESPONSE TO CONFLICT RESOLUTION ADVISORY PROTOTYPE Final Report, Apr. - Dec. 1991
K. M. Cardosi, M. Warner, P. W. Boole, P. Mengert, and R. Disario Jan. 1992 22 p Prepared in cooperation with EG and G Dynatrend, Inc., Woburn, MA
(PB92-190032; DOT-VNTSC-FAA-92-1; DOT/FAA/AM-92-03)
Avail: CASI HC A03/MF A01

Conflict Resolution Advisory (CRA) is an automated software aid for air traffic control specialists at air route traffic control centers (ARTCC's). CRA calculates, validates, and displays to the en route controller a single resolution for predicted separation violations detected by the conflict alert (CA) function. This simulation study was conducted to determine controller response time to a CRA message. The response time is the total time required for controllers to notice that the advisory is present, to read and comprehend the text message, and to decide that the resolution is acceptable. Since only the prototype software (CRAU) was available for the test, the only other issue that was formally addressed was controller comments on the CRA message format. The implication of the results study for the calculation of the delay that is to be expected between CRA onset and pilot response is also discussed. Author

N92-33609*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A WORKSTATION-BASED EVALUATION OF A FAR-FIELD ROUTE PLANNER FOR HELICOPTERS
David N. Warner, Jr. and Francis J. Moran Jun. 1991 24 p Original contains color illustrations
(RTOP 505-66-11)
(NASA-TM-102882; A-91011; NAS 1.15:102882) Avail: CASI HC A03/MF A01; 13 functional color pages

Helicopter flight missions at very low, nap of the Earth, altitudes place a heavy workload on the pilot. To aid in reducing this workload, Ames Research Center has been investigating various types of automated route planners. As part of an automated preflight mission planner, a route planner algorithm aids in selecting the overall (far-field) route to be flown. During the mission, the route planner can be used to replan a new route in case of unexpected threats or change in mission requirements. An evaluation of a candidate route planning algorithm, based on dynamic programming techniques is described. This algorithm meets most of the requirements for route planning, both preflight and during the mission. In general, the requirements are to minimize the distance and/or fuel and the deviation from a flight time schedule, and must be flyable within the constraints of available fuel and time. Author

N92-33629*# GTE Government Systems Corp., Chantilly, VA. Federal Systems Div.
INTERIM SERVICE ISDN SATELLITE (ISIS) SIMULATOR DEVELOPMENT FOR ADVANCED SATELLITE DESIGNS AND EXPERIMENTS Report, 15 Jan. - 30 Aug. 1992
Gerard R. Pepin 30 Aug. 1992 136 p
(Contract NASw-4520)
(NASA-CR-190671; NAS 1.26:190671) Avail: CASI HC A07/MF A02

The simulation development associated with the network models of both the Interim Service Integrated Services Digital Network (ISDN) Satellite (ISIS) and the Full Service ISDN Satellite (FSIS) architectures is documented. The ISIS Network Model design represents satellite systems like the Advanced Communications Technology Satellite (ACTS) orbiting switch. The FSIS architecture,

the ultimate aim of this element of the Satellite Communications Applications Research (SCAR) Program, moves all control and switching functions on-board the next generation ISDN communications satellite. The technical and operational parameters for the advanced ISDN communications satellite design will be obtained from the simulation of ISIS and FSIS engineering software models for their major subsystems. Discrete event simulation experiments will be performed with these models using various traffic scenarios, design parameters, and operational procedures. The data from these simulations will be used to determine the engineering parameters for the advanced ISDN communications satellite. Author

N92-33693# Technische Univ., Delft (Netherlands). Sectie Mathematische Geodesie en Puntsbepaling.
CALIBRATION OF GPS ANTENNAS Thesis [CALIBRATIE VAN GPS-ANTENNES]
M. W. vanderHoek Jan. 1992 124 p In DUTCH
(ETN-92-92034) Avail: CASI HC A06/MF A02

Global Positioning System (GPS) antennas were calibrated with a view to geodetic measurements and the densification of large networks. The position of the (imaginary) phase center of the antenna was determined with respect to the terrestrial point above which the antenna is located. As an aspect of the antenna calibration the position of the imaginary phase center was further analyzed on the basis of the Weltzell receiver combination test observations using different data analysis methods. The method using the estimation of three coordinates gives better results than that which fixes latitude and longitude. The position of the imaginary phase center depends on the fixing of the ambiguity parameters on integer values. ESA

N92-33809# Coast Guard Academy, New London, CT. Center for Advanced Studies.
INTEGRATED RUSSIAN VLF/OMEGA RECEIVER DESIGN Final Report
B. Peterson, K. Gross, E. Chamberlin, and T. Montague Jan. 1992 11 p
(PB92-193390; USCGA-TR-1-92) Avail: CASI HC A03/MF A01

With recent statements from Russian officials indicating their very long frequency (VLF) navigation system may be operated in the future for worldwide civil use, its potential use in conjunction with the existing Omega system is of renewed interest. The design of an Integrated Russian VLF/Omega Receiver implemented on a Texas Instruments TMS320C25 microprocessor based Ariel DSP 16 plug-in board installed in a PC-compatible portable computer is presented. The system also requires an external antenna, pre-amp, and frequency reference. The DSP16 board digitizes the radio frequency (RF) signal to 16 bits and then digitally mixes with the sines and cosines of the three Soviet frequencies plus 10.2, 11 1/3, and 13.6 kHz. The mixer outputs are lowpass filtered and the comb filters implemented for the respective epochs. The PC compatible computer accesses and processes the comb filter outputs, calculating and logging signal phase and amplitude. The design allows for each future expansion to include unique and VLF communications frequencies. Author

N92-33930# Defence Research Establishment, Ottawa (Ontario).
EVALUATION OF GPS FOR PRECISE ARTILLERY SURVEY POSITIONING AND POINTING
M. F. Vinnins and R. G. Apps Oct. 1991 64 p
(AD-A253019; DREO-TN-91-38) Avail: CASI HC A04/MF A01

Four GPS receivers including the Plessey PA9052, Ashtech XII, Trimble TRIMPACK, and Magellan NAV1000M were evaluated for performance and suitability for the positioning and pointing of artillery. Specifications for accuracy in positioning and pointing, an defined by STANAG 2373, are 17.5 metres (CEP) and 0.60 mils, respectively. The receivers were evaluated for static positioning, short and mid-range (= 11 km) way-pointing (bearing determination), differential positioning and way-pointing, kinematic positioning, and general receiver characteristics. The evaluations were carried out in Mar. 1991 and while Selective Availability (SA) was not implemented. Static positioning (without SA) met artillery specification. Bearing determination to a given waypoint, both short and mid-range, was 3 to 5 deg but improved under differential GPS processing to better than 0.1 deg. Kinematic survey yielded indeterminate results. The use of differential GPS under good satellite geometry conditions and with adequate observation times may be a feasible solution for the artillery survey positioning and pointing requirement. Other techniques employing GPS which show potential for this application are also discussed. GRA

N92-34150# Federal Aviation Administration, Atlantic City, NJ.
PHASE 1: FAA GPS CURVED APPROACH FLIGHT TESTS IN HONEYWELL GULFSTREAM 4, VOLUME 2 Technical Note, Oct. 1991
Victor T. Wullschleger and M. Bakry El-Arini (Mitre Corp., Atlantic City, NJ.) May 1992 80 p
(Contract FAA-T0704-E)
(DOT/FAA/CT-TN92/17-Vol-2) Avail: CASI HC A05/MF A01

Satellite based navigation systems offer the greatest potential to provide worldwide navigation capability while emerging satellite and receiver technology is expected to insure the accuracy needed for most navigation requirements on land, sea, or air. The Global Positioning System (GPS) is a Department of Defense maintained satellite-based navigation system. This report documents the first phase of a five-phase joint government/industry effort to explore the accuracy and operational benefits of GPS. Author

N92-34203*# California Polytechnic State Univ., San Luis Obispo. Transportation Research Group.
HUMAN FACTORS ISSUES IN THE USE OF ARTIFICIAL INTELLIGENCE IN AIR TRAFFIC CONTROL. OCTOBER 1990 WORKSHOP Final Report, Jun. 1990 - Dec. 1991
Stephen Hockaday and Sharon Kuhlenschmidt, ed. Dec. 1991 12 p Workshop held 3-5 Oct. 1990
(Grant NAG2-669)
(NASA-CR-190925; NAS 1.26:190925; TR-91-7) Avail: CASI HC A03/MF A01

The objective of the workshop was to explore the role of human factors in facilitating the introduction of artificial intelligence (AI) to advanced air traffic control (ATC) automation concepts. AI is an umbrella term which is continually expanding to cover a variety of techniques where machines are performing actions taken based upon dynamic, external stimuli. AI methods can be implemented using more traditional programming languages such as LISP or PROLOG, or they can be implemented using state-of-the-art techniques such as object-oriented programming, neural nets (hardware or software), and knowledge based expert systems. As this technology advances and as increasingly powerful computing platforms become available, the use of AI to enhance ATC systems can be realized. Substantial efforts along these lines are already being undertaken at the FAA Technical Center, NASA Ames Research Center, academic institutions, industry, and elsewhere. Although it is clear that the technology is ripe for bringing computer automation to ATC systems, the proper scope and role of automation are not at all apparent. The major concern is how to combine human controllers with computer technology. A wide spectrum of options exists, ranging from using automation only to provide extra tools to augment decision making by human controllers to turning over moment-by-moment control to automated systems and using humans as supervisors and system managers. Across this spectrum, it is now obvious that the difficulties that occur when tying human and automated systems together must be resolved so that automation can be introduced safely and effectively. The focus of the workshop was to further explore the role of injecting AI into ATC systems and to identify the human factors that need to be considered for successful application of the technology to present and future ATC systems. Author

N92-33351*# Bureau International des Poids et Mesures, Sevres (France).
THE NEED FOR GPS STANDARDIZATION
Wlodzimierz W. Lewandowski, Gerard Petit, and Claudine Thomas *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd

Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 1-13 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

N92-33352*# Omega Navigation System Center, Alexandria, VA. Global Positioning System Information Center Branch.
US COAST GUARD GPS INFORMATION CENTER (GPSIC) AND ITS FUNCTION WITHIN THE CIVIL GPS SERVICE (CGS)
Luann Barndt *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 15-34 Revised (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

N92-33353*# Aerospace Corp., El Segundo, CA.
EVALUATION OF GPS/UTC STEERING PERFORMANCE
W. A. Feess, H. Holtz, A. L. Satin, and Colleen H. Yinger *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 35-48 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

N92-33354*# National Oceanic and Atmospheric Administration, Rockville, MD. Ocean and Earth Sciences Div.
GPS ORBIT DETERMINATION AT THE NATIONAL GEODETIC SURVEY
Mark S. Schenewerk *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 49-58 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

N92-33355*# Bureau International des Poids et Mesures, Sevres (France).
PRECISE GPS EPHEMERIDES FROM DMA AND NGS TESTED BY TIME TRANSFER
Wlodzimierz W. Lewandowski, Gerard Petit, and Claudine Thomas *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 59-70 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

N92-33356*# Technische Univ., Graz (Austria).
COMPARISON OF TWO-WAY SATELLITE TIME TRANSFER AND GPS COMMON-VIEW TIME TRANSFER BETWEEN OCA AND TUG
Dieter Kirchner, U. Thyr, H. Ressler, R. Robnik, P. Grudler (Observatoire de la Cote d'Azur, Nice, France), Francoise S. Baumont (Observatoire de la Cote d'Azur, Nice, France), Christian Veillet (Observatoire de la Cote d'Azur, Nice, France), Wlodzimierz W. Lewandowski (Bureau International des Poids et Mesures, Sevres, France), W. Hanson (National Inst. of Standards and Technology, Boulder, CO.), and A. Clements (National Inst. of Standards and Technology, Boulder, CO.) et al *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 71-88 Sponsored by Bureau Nationale de Metrologie; Academy of Sciences; and Austrian National Bank (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

N92-33358*# Naval Observatory, Washington, DC. Time Service Dept.
LORAN-C DATA REDUCTION AT THE US NAVAL OBSERVATORY
Harold Chadsey *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 103-11 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

N92-33381*# Leeds Univ. (England). Dept. of Electronic and Electrical Engineering.
COMPARISON OF GLONASS AND GPS TIME TRANSFERS BETWEEN TWO WEST EUROPEAN TIME LABORATORIES AND VNIIFTRI
P. Daly, N. B. Koshelyaevsky (Vsesoyuznyi Nauchno-Issledovatelskii Inst. Radiatsionnoi Tekhniki, Moscow, USSR), Wlodzimierz Lewandowski (Bureau International des Poids et Mesures, Sevres, France), Gerard Petit (Bureau International des Poids et Mesures, Sevres, France), and Claudine Thomas (Bureau International des Poids et Mesures, Sevres, France) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 341-35 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.For land transportation vehicles see *85 Urban Technology and Transportation.*

N92-33404*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
THE F-18 HIGH ALPHA RESEARCH VEHICLE: A HIGH-ANGLE-OF-ATTACK TESTBED AIRCRAFT
Victoria Regenie, Donald Gatlin, Robert Kempel (PRC Kentron, Inc., Edwards, CA.), and Neil Matheny Sep. 1992 17 p Presented at the 6th Biennial Flight Test Conference, Hilton Head Island, SC, 24-26 Aug. 1992
(RTOP 533-02-35)
(NASA-TM-104253; H-1846; NAS 1.15:104253; AIAA Paper 92-4121) Copyright Avail: CASI HC A03/MF A01

The F-18 High Alpha Research Vehicle is the first thrust-vectoring testbed aircraft used to study the aerodynamics and maneuvering available in the poststall flight regime and to provide the data for validating ground prediction techniques. The aircraft includes a flexible research flight control system and full research instrumentation. The capability to control the vehicle at angles of attack up to 70 degrees is also included. This aircraft was modified by adding a pitch and yaw thrust-vectoring system. No significant problems occurred during the envelope expansion phase of the program. This aircraft has demonstrated excellent control in the wing rock region and increased rolling performance at high angles of attack. Initial pilot reports indicate that the increased capability is desirable although some difficulty in judging the size and timing of control inputs was observed. The aircraft, preflight ground testing and envelope expansion flight tests are described. Author

N92-33414# Naval Air Warfare Center, Warminster, PA. Air Vehicle and Crew Systems Technology Dept.
AN INVESTIGATION OF SWITCHED RELUCTANCE ROTOR POSITION ESTIMATION USING NEURAL NETWORKS
Progress Report, Oct. 1991 - Feb. 1992
Jenifer M. Shannon Feb. 1992 19 p
(AD-A252846; NAWCADWAR-92022-60) Avail: CASI HC A03/MF A01

The Switched Reluctance Machine (SRM) has potential applications in the More-Electric Aircraft program. Such applications include fuel and oil pump, actuators, braking systems, and integral starter/generators. However, one difficulty in the controller design still exists. Knowledge of the relative position of the rotor with the stator is required for timing of the excitation pulses. This position is conventionally measured by an encoder or resolver. However, for many applications of the SRM such a sensor will not operate in the harsh environment of the machine. Developing a means of estimating the rotor position without the need for a rotor-mounted

position sensor is the aim of this research. Specifically, this paper investigates the possibility of using neural networks for rotor position estimation. GRA

N92-33502# Naval Postgraduate School, Monterey, CA.
IMPLEMENTATION OF A PERSONAL COMPUTER BASED PARAMETER ESTIMATION PROGRAM M.S. Thesis
Robert G. Graham Mar. 1992 147 p
(AD-A252914) Avail: CASI HC A07/MF A02

Aircraft parameter estimation is the process of extracting numerical values for aerodynamic stability and control derivatives from flight test time history data. This process can be used as a verification or validation tool for results obtained from wind-tunnel testing or through computational analysis, and can obtain or improve estimations of dynamic derivatives. This study implements the MATLAB Personal Computer (PC) based maximum likelihood estimation routine for aircraft longitudinal and lateral-directional derivatives. The parameter estimation was first accomplished on generated simulated data, with and without noise. The noise consisted of measurement and state noise which used the Dryden Gust Model. Secondly, two actual longitudinal flight-test maneuvers are analyzed for the F-14A and the T-37 aircraft. Additionally, the simulated portion of this study can be an excellent instructional aid in Flight Dynamics and Flight Test Courses. GRA

N92-33582 Field Aviation Co., Inc., Mississauga (Ontario).
FIRE BOMBING AND FIRE BOMBERS Patent
John K. Hawkshaw, inventor (to CISTI) 24 Apr. 1990 21 p
(CA-Patent-1-268-164; Int-Patent-Class-B64D-1/16;
CTN-91-60132) Copyright Avail: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

This invention concerns the design of a drop tank and liquid discharge system for a fire bomber. An elongated discharge chute is designed such that the discharge end is located substantially below the tank. When released from the tank, the falling stream will accelerate to a substantial velocity within the chute before discharging. The through passage is progressively reduced in cross sectional area so that the discharged stream has a width transverse to the direction of travel which is less than its thickness in the direction of forward motion of the aircraft, that is, the emerging liquid has a reduced cross section and a streamlined shape. By these means, air entrapment in the free falling liquid is reduced, the time of travel to the target area is reduced, and the uniformity of coverage is improved. In addition, the fuselage of the firebomber is equipped with a tubular shield designed to prevent direct impingement of the airstream on the chute. A plurality of drop tanks may be located on a single aircraft. The ground wetness level may be varied by altering the chute width or by dumping more than one tank at a time. The dropping sequence may be computer controlled. CISTI

N92-33585 Pneumo Corp., Boston, MA.
LANDING GEAR MECHANISM INCLUDING RUNWAY-ROUGHNESS RESTRICTOR ASSEMBLY Patent
Louis C. Hrusch, inventor (to CISTI) 18 Jul. 1989 19 p
(CA-Patent-1-257-618; Int-Patent-Class-B64C-25/60;
CTN-91-60166) Copyright Avail: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

This invention relates to a landing gear restrictor assembly mechanism for substantially reducing or eliminating high damping loads as the landing gear negotiates bumps to permit high performance aircraft to operate on relatively rough runways. High performance may be achieved by a landing gear which is provided with different low spring rate load ranges. It can differentiate between shock strut extension during normal ground roll and extension as the strut tire follows a sudden recess during forward travel; prevent cavitation in the lower piston chamber of the gear as the gear extends; and provide for piston rebound damping as the piston approaches the end of its stroke during full extension. High damping loads on the landing gear can be reduced or eliminated. The invention is generally of the type described above but includes a simplified mechanism for substantially reducing or eliminating high damping loads as the gear negotiates bumps during taxiing. The mechanism can readily be packed into a small space within the envelope of the landing gear; it is incorporated within a restrictor assembly which also controls the rate of instroke of the gear during landing. The gear is also provided with restrictor means to restrict the return flow through a bypass passage surrounding the primary orifice during the outstroke movement of the gear but not during taxiing after landing has taken place. CISTI

N92-33750# Rolls-Royce Ltd., Derby (England).
THE ROLLS-ROYCE TRENT
Giles Harvey 1 May 1991 15 p Presented at the Royal Aeronautical Society, Hong Kong, China, May 1991
(PNR-90875; ETN-92-92185) Copyright Avail: CASI HC A03/MF A01

The design philosophy of the wide bodied Trent aircraft is discussed and principal design features are described. The Trent is a derivative of the RB211 family. The consistent design approach through three generations is outlined. The unique wide-chord fan blade manufacturing sequence, involving superplastic forming and diffusion bonding, is described. A computer model of the engine structure of the Trent 800, and performance retention features, are shown. Structural analysis and design, including finite element analysis, is described. ESA

N92-33874*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HIGH-SPEED RESEARCH: SONIC BOOM, VOLUME 1
Christine M. Darden, comp. Washington Oct. 1992 195 p Workshop held in Hampton, VA, 25-27 Feb. 1992
(RTOP 537-03-21-01)
(NASA-CP-3172; L-17145-Vol-1; NAS 1.55:3172) Avail: CASI HC A09/MF A03

A High-Speed Sonic Boom Workshop was held at LaRC of Feb. 25-27, 1992. The purpose was to make presentations on current research activities and accomplishments and to assess progress in the area of sonic boom since the program was initiated in FY-90. Twenty-nine papers were presented during the 2-1/2 day workshop. Attendees included representatives from academia, industry, and government who are actively involved in sonic-boom research. Volume 1 contains papers related to atmospheric effects on the sonic-boom signature during propagation and on acceptability studies. For individual titles, see N92-33875 through N92-33886.

N92-33875*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE PEKERIS PROBLEM, AND THE INTERIOR OF THE PULSATING SPHERE, FIRST SUCCESS OF EXACT RAY THEORY, AND WHAT RAYS? **c70**
Gerry L. McAninch *In its* High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 1-5 (For primary document see N92-33874 24-05)
Avail: CASI HC A01/MF A03

This paper presents what is probably the first application of exact ray theory to provide nontrivial exact solutions of the Helmholtz equation. First, the Pekeris problem is considered. This is followed by consideration of the problem of the field maintained within a uniformly pulsating sphere. In the Pekeris problem, an iterative solution provides the exact solution on the second iteration. In the second problem, it is shown that the exact ray theory eliminates the focus of the geometric theory. Author

N92-33876*# Texas Univ., Austin. Applied Research Labs.
A NUMERICAL MODEL FOR SONIC BOOM PROPAGATION THROUGH AN INHOMOGENEOUS, WINDY ATMOSPHERE **c71**
Leick D. Robinson *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 7-30 (For primary document see N92-33874 24-05)
(Contracts N00039-88-C-0043; N00039-91-C-0082)
Avail: CASI HC A03/MF A03

The ZEPHYRUS computer model calculates sonic boom distortion during propagation through the atmosphere. The model includes the effects of nonlinear distortion, attenuation, dispersion, and wind. Trial runs with the model indicate that, in general, stable shocks have not formed when the sonic boom reaches the ground. Also, the rise time of the lead shock may strongly depend on the overall waveform shape, and may be significantly increased by purely dispersive effects when matching occurs between the rise time and the characteristic oxygen molecular relaxation time.

Author

N92-33877*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

WAVE EQUATIONS AND COMPUTATIONAL MODELS FOR SONIC BOOM PROPAGATION THROUGH A TURBULENT ATMOSPHERE **c71**

Allan D. Pierce *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 31-48 (For primary document see N92-33874 24-05)
(Grant NAG1-947)
Avail: CASI HC A03/MF A03

The improved simulation of sonic boom propagation through the real atmosphere requires greater understanding of how the transient acoustic pulses popularly termed sonic booms are affected by atmospheric turbulence. A nonlinear partial differential equation that can be used to simulate the effects of smaller-scale atmospheric turbulence on sonic boom waveforms is described. The equation is first order in the time derivative and involves an extension of geometrical acoustics to include diffraction phenomena. Various terms in the equation are explained in physical terms. Such terms include those representing convection at the wave speed, diffraction, molecular relaxation, classical dissipation, and nonlinear steepening. The atmospheric turbulence enters through an effective sound speed, which varies with all three spatial coordinates, and which is the sum of the local sound speed and the component of the turbulent flow velocity projected along a central ray that connects the aircraft trajectory with the listener.

Author

N92-33878*# Pennsylvania State Univ., University Park.

SIMULATIONS OF SONIC BOOM RAY TUBE AREA FLUCTUATIONS FOR PROPAGATION THROUGH ATMOSPHERIC TURBULENCE INCLUDING CAUSTICS VIA A MONTE CARLO METHOD **c71**

Victor W. Sparrow and Allan D. Pierce *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 49-62 (For primary document see N92-33874 24-05)
(Grant NAG1-947)
Avail: CASI HC A03/MF A03

A theory which gives statistical predictions for how often sonic booms propagating through the earth's turbulent boundary layer will encounter caustics, given the spectral properties of the atmospheric turbulence, is outlined. The theory is simple but approximately accounts for the variation of ray tube areas along ray paths. This theory predicts that the variation of ray tube areas is determined by the product of two similar area factors, psi (x) and phi (x), each satisfying a generic harmonic oscillator equation. If an area factor increases the peak acoustic pressure decreases, and if the factor decreases the peak acoustic pressure increases. Additionally, if an area factor decreases to zero and becomes negative, the ray has propagated through a caustic, which contributes a phase change of 90 degrees to the wave. Thus, it is clear that the number of times that a sonic boom wave passes through a caustic should be related to the distorted boom waveform received on the ground. Examples are given based on a characterization of atmospheric turbulence due to the structure function of Tatarski as modified by Crow. Author

N92-33879*# Pennsylvania State Univ., University Park.

ANALYSIS OF SONIC BOOM DATA TO QUANTIFY DISTORTIONS OF SHOCK PROFILES **c71**

Thomas A. Gionfriddo *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 63-76 (For primary document see N92-33874 24-05)
(Grant NAG1-947)
Avail: CASI HC A03/MF A03

Researchers at Penn State have been examining some sonic boom waveforms recorded during overflights by the Air Force which have become available to NASA and its contractors. The quality of the digitized data and the supporting meteorological data was such that one could test the applicability of molecular relaxation theories. In the late sixties, it had been supposed that the finite rise times in the absence of turbulence had neglected the vibrational relaxation of nitrogen molecules. Bass et al. have demonstrated that molecular relaxation definitely gives the correct order of magnitude of the observed rise times. However, the Air Force data in conjunction with the recent steady-state shock profile model theory of Kang and Pierce give the first opportunity to make a detailed quantitative assessment of the molecular relaxation hypothesis. Currently an investigation is ongoing to establish a method of quantifying the distortion of a sonic boom wave from a classic N-wave shape using the Air Force data taken at Edwards AFB in 1987. Using the premise that energy will be conserved approximately for a sonic boom wave both before and after the boom passes through the Earth's turbulent boundary layer, a classic undistorted waveform is constructed from the distorted signature received at the ground. A correlation between the mean-squared deviation of the distorted and undistorted waveforms and the distance the boom travels through the turbulence is sought.

Author

N92-33880*# Wyle Labs., Inc., Arlington, VA.

THE EFFECT OF TURBULENCE ON THE LOUDNESS OF MINIMIZED SONIC BOOM SIGNATURES **c71**

Kenneth J. Plotkin *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 77-95 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

An important issue for shaped minimized sonic booms is whether turbulence-induced distortions will adversely affect the benefits gained by shaping. This question was considerably simplified by two recent results. The first is the finding that the loudness of sonic booms is well quantified by loudness. The second is that loudness of a shaped boom is dominated by the shock waves. The issue is now the effect of turbulence on weak (1 psf or less) sonic booms. Since it is clear that molecular relaxation effects have a significant effect on shock structure and loudness, turbulence effects must be examined in conjunction with relaxation-thickened shocks. This analysis must be directed toward loudness calculations and include all pertinent mechanisms.

Author

N92-33881*# Texas Univ., Austin. Applied Research Labs. and Mechanical Engineering Dept.

MODEL EXPERIMENT TO STUDY THE EFFECT OF TURBULENCE ON RISETIME AND WAVEFORM OF N WAVES **c71**

Bart Lipkens and David T. Blackstock *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 97-107 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

Typical measured sonic boom rise times are two to five times longer than rise times calculated using molecular relaxation theory. The difference may be due to atmospheric turbulence. A model experiment was set up to study the influence of turbulence on waveform and rise time of spark-produced N waves. The N waves propagate through turbulence generated by a plane jet. The model turbulence is scaled down from atmospheric turbulence by approximately the same factor as the model N wave is scaled down from the sonic boom. Our experiments show that passage through the turbulence produces a wide variety of changes in the N waveform. Spiked and rounded N waves are observed, and average rise time is increased by a factor of about 2. A tentative observation based on data obtained so far is that rise time is always increased, never decreased, by turbulence. Author

N92-33882*# Mississippi Univ., University. Dept. of Physics and Astronomy.
STEADY STATE RISETIMES OF SHOCK WAVES IN THE ATMOSPHERE **c71**
Richard Raspet, Henry Bass, Lixin Yao, and Wenliang Wu *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 109-115 (For primary document see N92-33874 24-05)
Avail: CASI HC A02/MF A03

A square wave shape is used in the Pestorius algorithm to calculate the risetime of a step shock in the atmosphere. These results agree closely with steady shock calculations. The healing distance of perturbed shocks due to finite wave effects is then investigated for quasi-steady shocks. Perturbed 100 Pa shocks require on the order of 1.0 km travel distance to return to within 10 percent of their steady shock risetime. For 30 Pa shocks, the minimum recovery distance increases to 3.0 km. It is unlikely that finite wave effects can remove the longer risetimes and irregular features introduced into the sonic boom by turbulent scattering in the planetary boundary layer. Author

N92-33883*# Air Force Systems Command, Wright-Patterson AFB, OH.
LATERAL SPREAD OF SONIC BOOM MEASUREMENTS FROM US AIR FORCE BOOMFILE FLIGHT TESTS **c71**
J. Micah Downing *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 117-135 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

A series of sonic boom flight tests were conducted by the US Air Force at Edwards AFB in 1987 with current supersonic DOD aircraft. These tests involved 43 flights by various aircraft at different Mach number and altitude combinations. The measured peak overpressures to predicted values as a function of lateral distance are compared. Some of the flights are combined into five groups because of the varying profiles and the limited number of sonic booms obtained during this study. The peak overpressures and the lateral distances are normalized with respect to the Carlson method predicted centerline overpressures and lateral cutoff distances, respectively, to facilitate comparisons between sonic boom data from similar flight profiles. It is demonstrated that the data agrees with sonic boom theory and previous studies and adds to the existing sonic boom database by including sonic boom signatures, tracking, and weather data in a digital format. Author

N92-33884*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PRELIMINARY RESULTS FROM THE WHITE SANDS MISSILE RANGE SONIC BOOM PROPAGATION EXPERIMENT **c71**
William L. Willshire, Jr. and David W. DeVilbiss (Lockheed Engineering and Sciences Co., Hampton, VA.) *In its* High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 137-149 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

Sonic boom bow shock amplitude and rise time statistics from a recent sonic boom propagation experiment are presented. Distributions of bow shock overpressure and rise time measured under different atmospheric turbulence conditions for the same test aircraft are quite different. The peak overpressure distributions are skewed positively, indicating a tendency for positive deviations from the mean to be larger than negative deviations. Standard deviations of overpressure distributions measured under moderate turbulence were 40 percent larger than those measured under low turbulence. As turbulence increased, the difference between the median and the mean increased, indicating increased positive overpressure deviations. The effect of turbulence was more readily seen in the rise time distributions. Under moderate turbulence conditions, the rise time distribution means were larger by a factor of 4 and the standard deviations were larger by a factor of 3 from the low turbulence values. These distribution changes resulted in a transition from a peaked appearance of the rise time distribution for the morning to a flattened appearance for the afternoon rise time distributions. The sonic boom propagation experiment consisted of flying three types of aircraft supersonically over a ground-based microphone array with concurrent measurements of turbulence and other meteorological data. The test aircraft were a T-38, an F-15, and an F-111, and they were flown at speeds of Mach 1.2 to 1.3, 30,000 feet above a 16 element, linear microphone array with an inter-element spacing of 200 ft. In two weeks of testing, 57 supersonic passes of the test aircraft were flown from early morning to late afternoon. Author

N92-33885*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUBJECTIVE LOUDNESS RESPONSE TO SIMULATED SONIC BOOMS **c71**
Jack D. Leatherwood and Brenda M. Sullivan (Lockheed Engineering and Sciences Co., Hampton, VA.) *In its* High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 151-170 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

A series of laboratory studies were conducted at LaRC to: (1) quantify the effects of sonic boom signature shaping on subjective loudness; (2) evaluate candidate loudness metrics; (3) quantify the effects of signature asymmetry on loudness; and (4) document sonic boom acceptability within the laboratory. A total of 212 test subjects evaluated a wide range of signatures using the NASA Langley Research Center's sonic boom simulator. Results indicated that signature shaping via front-shock minimization was particularly effective in reducing subjective loudness without requiring reductions in peak overpressure. Metric evaluations showed that A-weighted sound exposure level, Perceived Level (Stevens Mark 7), and Zwicker's Loudness level were effective descriptors of the loudness of symmetrical shaped signatures. The asymmetrical signatures were generally rated as being quieter than symmetrical signatures of equal calculated metric level. The magnitude of the loudness reductions were observed to increase as the degree of asymmetry increased and to be greatest when the rear half of the signature was loudest. This effect was not accounted for by the loudness metrics. Sonic boom acceptability criteria were determined within the laboratory. These agreed well with results previously obtained in more realistic situations. Author

N92-33886*# Wyle Labs., Inc., El Segundo, CA.
EVALUATION OF HUMAN RESPONSE TO STRUCTURAL VIBRATION INDUCED BY SONIC BOOM **c53**
L. C. Sutherland and J. Czech *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 171-195 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

This paper addresses the topic of building vibration response to sonic boom and the evaluation of the associated human response to this vibration. The paper reexamines some of the issues addressed in the previous extensive coverage of the topic, primarily by NASA, and attempts to offer a fresh viewpoint for some of the problems that may assist in reassessing the potential impact of sonic boom over populated areas. The topics addressed are: (1) human response to vibration; (2) criteria for, and acoustic signature of rattle; (3) structural response to shaped booms, including definition of two new descriptors for assessing the structural response to sonic boom; and (4) a detailed review of the previous NASA/FAA Sonic Boom Test Program involving structural response measurements at Edwards AFB and an initial estimate of structural response to sonic booms from possible high speed civil transport configurations. Finally, these estimated vibration responses are shown to be substantially greater than the human response and rattle criteria developed earlier. Author

N92-33932 Georgia Inst. of Tech., Atlanta.
ON MINIMUM TIME SIX-DEGREE-OF-FREEDOM TURNING MANEUVERS FOR A HIGH-ALPHA FIGHTER AIRCRAFT Ph.D. Thesis
Eric Gilles Hoffman 1991 236 p
Avail: Univ. Microfilms Order No. DA9206085

Maneuverability has been recognized as an essential

characteristic of a modern fighter. Being able to turn tighter and faster has direct consequences on the outcome of air combat. It is a key to survival. The focus of this study is minimum time turning maneuvers. An analytical aircraft model is derived from aerodynamical and propulsive data provided NASA Langley Research Center. Subsequently, the equations of motion are written for six degree of freedom flight. Quaternions are used instead of Euler angles to avoid singularities. After reviewing the agility metrics used in the past, a new metric is introduced. Based on differential geometry, it is maneuver independent, jerk related and describes both fuselage aiming and velocity vector point capabilities. When studying the classical turning performance of the model, sustained turns, constant energy turns are considered. They yield maximum turn rates about 10 degrees/s. The minimum time turning problem is set up as a two point boundary value problem. The Maximum Principle is used to derive optimality conditions. Multiple shooting proves not to be a practical method to solve the problem because of the complexity of the system. A nonlinear programming algorithm is used to solve the parameter optimization problem. Minimum time fuselage aiming and minimum time velocity vector pointing problems are considered. Six-degree-of-freedom extremal solutions are obtained. Multiple families of locally extremal solutions are found. The fastest fuselage aiming 180 degrees turn is found to be a split-s performed in 7.37 seconds, the fastest velocity pointing turn is also a split-s but takes 12.71 seconds. Horizontal turns, 3D drives, and pitch up maneuvers are encountered but are not as fast. Lateral thrust vectoring is investigated and does not bring major improvement in performance. With a point mass approach only velocity vector pointing could have been considered. Finally, the variables of the system are separated using a spectral method. Each extremal maneuver obtained previously yields a different state variable ordering. Angle of attack and bank angle appear not to be always the fastest variables along the extremal trajectories. Therefore, using them as controls in a point mass model cannot always be justified. Dissert. Abstr.

N92-33952 Minnesota Univ., Minneapolis.
DESIGN OF HELICOPTER FLIGHT CONTROL SYSTEMS FOR HOVER AND LOW SPEED USING EIGENSTRUCTURE ASSIGNMENT Ph.D. Thesis
Eicher Low 1991 232 p
Avail: Univ. Microfilms Order No. DA9205453

An eigenstructure-based design methodology for helicopter flight control systems is developed and evaluated. The technique allows the designer to synthesize control laws which result in desirable response types such as attitude command attitude hold, rate command, and translational rate command position hold. Eigenstructure assignment is used to design inner loop control laws which provide decoupled first-order rate command response in roll pitch and yaw rates and vertical velocity with appropriate bandwidths, and stabilize low frequency open loop instabilities. Outer loop control laws achieve desired response types through classical frequency response design techniques. The control laws were designed for a generic high performance helicopter operating at hover. These control laws were evaluated with the mathematical models used in the design process and were found to yield excellent dynamic response characteristics in both the time and frequency domains. The control laws yielded good tracking of pilot command and attenuation of atmospheric disturbances. They also provided Level 1 handling qualities when evaluated using the design model. The stability robustness of the control laws in the presence of modeling uncertainties was evaluated using unstructured singular values. A simple time delay model of the errors due to neglected high frequency dynamics was used in this analysis and the stability robustness of the system was shown to be acceptable. More detailed robustness analyses were accomplished using structured singular value techniques and computer simulations of dynamic response using an off-nominal flight condition as well as higher order models. Actuator dynamics, rotor dynamics, time delays due to digital implementation of flight control laws, and errors in aerodynamic stability and control derivatives were included in these robustness analyses. The stability and performance robustness of the feedback control laws were shown to be acceptable and in no case were handling qualities less than Level 2 obtained. Eigenstructure assignment provides a straightforward method for design of helicopter flight control systems that will improve handling qualities. The control laws are relatively simple to implement and do not require high order dynamic compensators in the feedback loops. Furthermore, the eigenstructure control laws provide good robustness properties. Dissert. Abstr.

N92-33953 Minnesota Univ., Minneapolis.
NONLINEAR DYNAMIC-INVERSION FLIGHT CONTROL OF SUPERMANEUVERABLE AIRCRAFT Ph.D. Thesis
Sidney Antony Snell 1991 287 p
Avail: Univ. Microfilms Order No. DA9207806

The objective of this research was to design flight control laws for supermaneuverable aircraft. Such aircraft routinely operate with high angle-of-attack and high angular rates where nonlinearities are significant. The research showed that a nonlinear dynamic-inversion control law could be readily designed and implemented. The control law exploited the two-time scale nature of the controlled dynamics. This allowed the design to consist of two first-order inversions in sequence. One inversion used three high-bandwidth inner loops to control the fast states corresponding to the three body-axis, angular rates. The second inversion was approximate and employed outer loops to control the angle-of-attack, sideslip angle, and the rate of the bank angle about the velocity vector. Simulations of aggressive maneuvers showed that the control law provides accurate control of these variables, even in the presence of static perturbations to the mathematical model. For comparison, a more conventional, gain-scheduled linear controller was designed. The gain-scheduled controller produced less accurate control of the angle-of-attack and higher levels of sideslip and lateral acceleration than the dynamic-inversion system. Dynamic inversion offers a natural method of incorporating thrust vectoring control into the control law. This produced smaller control deflections during simulations than the gain-scheduled system. An enhancement to the dynamic-inversion control law was developed to allow the aircraft to reach very high roll rates, causing the ailerons to saturate, while retaining accurate control of sideslip. A secondary objective in the research was to design a maneuver generator, to provide the pilot commands during the simulations. The basic maneuver generator, which uses dynamic inversion of the point-mass equations, provides adequate performance. Various configurations of maneuver generator are examined, and possible enhancements are suggested. Dissert. Abstr.

N92-34039*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, CA.
EXPERIENCE WITH Ada ON THE F-18 HIGH ALPHA RESEARCH VEHICLE FLIGHT TEST PROGRAM
Victoria A. Regenie, Michael Earls, Jeanette Le, and Michael Thomson (PRC Kentron, Inc., Edwards, CA.) Oct. 1992 17 p Proposed for presentation at the IEEE/AIAA Digital Avionics Systems Conference, Seattle, WA, 5-8 Oct. 1992
(RTOP 533-02-35)
(NASA-TM-104259; H-1860; NAS 1.15:104259) Avail: CASI HC A03/MF A01

Considerable experience was acquired with Ada at the NASA Dryden Flight Research Facility during the on-going High Alpha Technology Program. In this program, an F-18 aircraft was highly modified by the addition of thrust-vectoring vanes to the airframe. In addition, substantial alteration was made in the original quadruplex flight control system. The result is the High Alpha Research Vehicle. An additional research flight control computer was incorporated in each of the four channels. Software for the research flight control computer was written in Ada. To date, six releases of this software have been flown. This paper provides a detailed description of the modifications to the research flight control system. Efficient ground-testing of the software was accomplished by using simulations that used the Ada for portions of their software. These simulations are also described. Modifying and transferring the Ada for flight software to the software simulation configuration has allowed evaluation of this language.

This paper also discusses such significant issues in using Ada as portability, modifiability, and testability as well as documentation requirements. Author

N92-34182# RAND Corp., Santa Monica, CA.
ADVANCED AIRFRAME STRUCTURAL MATERIALS: A PRIMER AND COST ESTIMATING METHODOLOGY
Susan A. Resetar, J. C. Rogers, and Ronald W. Hess 1991 117 p
(Contract F49620-91-C-0003)
(AD-A253371; RAND/R-4016-AF) Avail: CASI HC A06/MF A02

This report identifies, describes, and quantifies the cost effects of structural materials that are likely to be incorporated into aircraft becoming operational in the 1990s (aluminum, aluminum-lithium, steel, titanium, graphite/epoxy, graphite/bismaleimide, and graphite/ thermoplastic). The first half of this report is a primer for advanced aircraft structural materials emphasizing polymer matrix composites. The second half of the report contains both cost data and a cost estimating methodology sensitive to material mix. For each material type separate cost factors are presented for two time frames, the late 1980s and the mid-1990s, and for the following cost elements: nonrecurring engineering, nonrecurring tooling, recurring engineering, recurring tooling, manufacturing labor, manufacturing material, and quality assurance. These factors are based on data obtained from Boeing Airplane Company, General Dynamics Corporation, Grumman Aerospace Corporation, Lockheed Aerospace Systems Corporation-California Division and Georgia Division, LTV Aerospace and Defense Aircraft Group, McDonnell Douglas Corporation, Northrop Aircraft Division, and Rockwell International Group. GRA

N92-34202*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
THERMAL-STRUCTURAL TEST FACILITIES AT NASA DRYDEN
V. Michael DeAngelis and Karl F. Anderson Aug. 1992 15 p Presented at the 23rd Annual Society for Flight Test Engineers Symposium, Hauppauge, NY, 3-6 Aug. 1992
(RTOP 505-62-40)
(NASA-TM-104249; H-1818; NAS 1.15:104249) Avail: CASI HC A03/MF A01

The National Aero-Space Plane (NASP) has renewed interest in hypersonic flight and hot-structures technology development for both the airframe and engine. The NASA Dryden Thermostructures Research Facility is a unique national facility that was designed to conduct thermal-mechanical tests on aircraft and aircraft components by simulating the flight thermal environment in the laboratory. The layout of the facility is presented, which includes descriptions of the high-bay test area, the instrumentation laboratories, the mechanical loading systems, and the state-of-the-art closed-loop thermal control system. The hot-structures test capability of the facility is emphasized by the Mach-3 thermal simulation conducted on the YF-12 airplane. The Liquid-Hydrogen Structural Test Facility, which is presently in the design phase, will provide the capability of thermally testing structures containing hydrogen. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N92-33277# Krug Life Sciences, Inc., San Antonio, TX.
THE UTILITY OF ANALOG VERTICAL VELOCITY INFORMATION DURING INSTRUMENT FLIGHT WITH A HEAD-UP DISPLAY (HUD) Final Technical Report, Jan. 1991 - Jan. 1992
Lisa F. Weinstein, William R. Ercoline, and Richard H. Evans Jun. 1992 23 p
(Contract F33615-89-C-0603)
(AD-A252863; AL-TP-1992-0021) Avail: CASI HC A03/MF A01

The United States Air Force (USAF) is attempting to create a standard symbol set for use with the HUD as a primary flight reference. As part of that effort, eight HUD-experienced pilots and twelve non-HUD-experienced pilots participated in a study that examined the effects of variations in vertical velocity indicators (VVI) for use under instrument flight conditions in a simulator. Five configurations were assessed: digital readout, boxed digits with tape, dial, altimeter arc, and altimeter arc with digital readout. The results clearly indicated that the altimeter arc with digital readout, and the altimeter arc alone, resulted in significantly more accurate maintenance of flight parameters (i.e., vertical velocity and altitude) than did the digital readout alone, the boxed digits with tape, or the dial. Subjective data supported the objective findings, in that pilots preferred either configuration that included the altimeter arc. These findings suggest that analog vertical velocity information is useful on the HUD, particularly when it is located in close proximity to the altimeter. GRA

N92-33540# Air Force Occupational Measurement Center, Randolph AFB, TX.
F-16 AVIONIC SYSTEMS ATTACK CONTROL INSTRUMENT AND FLIGHT CONTROL COMMUNICATION, NAVIGATION, AND PENETRATION AIDS. TRAINING REQUIREMENTS ANALYSIS 452X2, VOLUME 1
Wendy J. Sotello, John T. Penner, III, and Cynthia K. Scharf Mar. 1992 50 p
(AD-A252786) Avail: CASI HC A03/MF A01

The purpose of this training requirements analysis (TRA) is to assist in determining training requirements for F-16 Avionics Systems personnel in light of recent RIVET WORKFORCE (RWF) restructuring efforts. The information may be used to evaluate the adequacy, feasibility, and efficiency of the training provided within this rapidly changing specialty. Data for this TRA were gathered by means of field interviews with F-16 Avionics Systems personnel. The TRA task list was extracted from the March 1989 452X2 USAF Job Inventory (JI). A total of 21 subject- matter experts (SMEs) at 2 TAC bases and 1 ATC base were interviewed to gather task data and other training decision data. In addition, system overview information was gathered from HQ USAF, the TAC functional manager, and members of Lowry Technical Training Center (LTTC). The analysis of collected data resulted in both general and specific training recommendations. These recommendations are designed to create the best possible training environment, given realistic constraints in the areas of manpower and resources. GRA

N92-34109*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
COMPUTATIONAL ALGORITHMS FOR INCREASED CONTROL OF DEPTH-VIEWING VOLUME FOR STEREO THREE-DIMENSIONAL GRAPHIC DISPLAYS
Steven P. Williams and Russell V. Parrish Aug. 1992 26 p
(RTOP 505-67-01-04)
(NASA-TM-4379; L-16829; NAS 1.15:4379;
AVSCOM-TR-92-E-002) Avail: CASI HC A03/MF A01

Three-dimensional pictorial displays incorporating depth cues by means of stereopsis offer a potential means of presenting information in a natural way to enhance situational awareness and improve operator performance. Conventional computational techniques rely on asymptotic projection transformations and symmetric clipping to produce the stereo display. Implementation of two new computational techniques, as asymmetric clipping algorithm and piecewise linear projection transformation, provides the display designer with more control and better utilization of the effective depth-viewing volume to allow full exploitation of stereopsis cuing. Asymmetric clipping increases the perceived field of view (FOV) for the stereopsis region. The total horizontal FOV provided by the asymmetric clipping algorithm is greater throughout the scene viewing envelope than that of the symmetric algorithm. The new piecewise linear projection transformation allows the

designer to creatively partition the depth-viewing volume, with freedom to place depth cuing at the various scene distances at which emphasis is desired. Author

N92-33340*# Honeywell, Inc., Minneapolis, MN. Systems and Research Center.
STUDY OBJECTIVES: WILL COMMERCIAL AVIONICS DO THE JOB? IMPROVEMENTS NEEDED?
Hatem Nasr *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 489-497 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N92-33479*# Pratt and Whitney Aircraft Group, East Hartford, CT.
LIFE PREDICTION AND CONSTITUTIVE MODELS FOR ENGINE HOT SECTION ANISOTROPIC MATERIALS PROGRAM Final Report
D. M. Nissley, T. G. Meyer, and K. P. Walker (Engineering Science Software, Inc., Smithfield, RI.) Sep. 1992 312 p
(Contract NAS3-23939; RTOP 590-21-11)
(NASA-CR-189223; NAS 1.26:189223; PWA-5968-102) Avail: CASI HC A14/MF A03

This report presents a summary of results from a 7 year program designed to develop generic constitutive and life prediction approaches and models for nickel-based single crystal gas turbine airfoils. The program was composed of a base program and an optional program. The base program addressed the high temperature coated single crystal regime above the airfoil root platform. The optional program investigated the low temperature uncoated single crystal regime below the airfoil root platform including the notched conditions of the airfoil attachment. Both base and option programs involved experimental and analytical efforts. Results from uniaxial constitutive and fatigue life experiments of coated and uncoated PWA 1480 single crystal material formed the basis for the analytical modeling effort. Four single crystal primary orientations were used in the experiments: group of zone axes (001), group of zone axes (011), group of zone axes (111), and group of zone axes (213). Specific secondary orientations were also selected for the notched experiments in the optional program. Constitutive models for an overlay coating and PWA 1480 single crystal materials were developed based on isothermal hysteresis loop data and verified using thermomechanical (TMF) hysteresis loop data. A fatigue life approach and life models were developed for TMF crack initiation of coated PWA 1480. A life model was developed for smooth and notched fatigue in the option program. Finally, computer software incorporating the overlay coating and PWA 1480 constitutive and life models was developed. Author

N92-33645# Technische Univ., Brunswick (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik.
A MULTIVARIABLE CONTROL CONCEPT FOR A GAS TURBINE ENGINE Ph.D. Thesis [MEHRGROESSEN-REGELUNGSKONZEPT FUER EIN GASTURBINENTRIBWERK]
Harald Soelter 1991 169 p In GERMAN
(ETN-92-92104) Avail: CASI HC A08/MF A02

An alternative control concept is presented for LARZAC 04 type gas turbine. It is shown that a possible way to systematize the design process is to use concepts of methodical projects from adjacent fields. The gas turbine engine process and the detailed control requirements are examined. The engine control system, theoretical linear engine control concepts, and examples for control systems for similar complex processes are analyzed. The obtained results lead to the formulation of a control structure, which is based on an adaptive anticipated control in connection with a multivariable control, which is used to maintain the state of the process in the allowed operating range, even in the case of disturbances or parameter divergences. ESA

N92-33746*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NAVIER-STOKES ANALYSIS AND EXPERIMENTAL DATA COMPARISON OF COMPRESSIBLE FLOW IN A DIFFUSING S-DUCT
Gary J. Harloff (Sverdrup Technology, Inc., Brook Park, OH.), Bruce A. Reichert, and Steven R. Wellborn (Iowa State Univ. of Science and Technology, Ames.) Jul. 1992 11 p Presented at the 10th Applied Aerodynamics Conference Exhibit, Palo Alto, CA, 22-24 Jun. 1992; sponsored by AIAA Previously announced in IAA as A92-45541
(Contract NAS3-25266; RTOP 505-62-52)
(NASA-TM-105683; E-7062; NAS 1.15:105683; AIAA Paper 92-2699) Avail: CASI HC A03/MF A01

Full three-dimensional Navier-Stokes computational results are compared with new experimental measurements for the flowfield within a round diffusing S-duct. The present study extends previous computational and experimental results for a similar smaller scale S-duct. Predicted results are compared with the experimental static and total pressure fields, and velocity vectors. Additionally, wall pressures, velocity profiles in wall coordinates, and skin friction values are presented. The CFD results employ algebraic and k-epsilon turbulence models. The CFD computed and experimentally determined separated flowfield is carefully examined. Author

N92-33748# Rolls-Royce Ltd., Derby (England).
RE-ENGINING FOR REAL STAGE 3 COMPLIANCE Progress Report
K. Goddard and M. R. Sellar 4 May 1992 15 p Presented at the Aircraft Noise Attenuation and Regulatory Update, Miami, FL, 3-5 Apr. 1991
(PNR-90872; ETN-92-92183) Copyright Avail: CASI HC A03/MF A01

Noise legislation developments relevant to noisy stage 2 aircraft are described, and reengining for noise reduction to stage 3 compliance is discussed. The Rolls Royce Tay engine is addressed, and Tay 650 design features and noise reductions are described. The status of current programs for the BAC1-11-2400, B727-1000, and Tay 670, is outlined. The current business scene, aircraft resale values, and lease rates, are discussed. ESA

N92-33749# Rolls-Royce Ltd., Derby (England).
AN IMPROVED COMPRESSOR PERFORMANCE PREDICTION MODEL
P. I. Wright and D. C. Miller 4 Apr. 1992 13 p
(PNR-90873; ETN-92-92184) Copyright Avail: CASI HC A03/MF A01

The improvement of a mean line compressor performance prediction model is reported. The overall characteristic is generated by the mean line stacking of blade row characteristics generated from mid-radius blading data. New correlations for freestream and end wall losses, together with an improved shock loss model, were included. The effect of Reynolds number on loss was incorporated. An improved correlation for deviation based both on empirical data and on a blade to blade time marching analysis was derived. The correlation for throat area was improved, and this is used together with inlet Mach number as the basis for a correlation of minimum loss incidence. A correlation for blockage factor is included. The methods for predicting the effect of off-design incidence on loss and deviation and the definition of the surge line are unchanged from those previously reported. The empirical coefficients included in the compressor performance

prediction model were calibated using single stage test data at design and part speed. ESA

N92-33815# Rolls-Royce Ltd., Bristol (England). Experimental Vibration Dept.
JOINT STUDY ON THE COMPUTERISATION OF IN-FIELD AERO ENGINES VIBRATION DIAGNOSIS
H. R. Carr 1 Nov. 1990 11 p Sponsored by Ministry of Defence
(PNR-90799; ETN-92-92177) Copyright Avail: CASI HC A03/MF A01

A program to develop software based diagnostics for rotor dynamic symptoms in fixed wing engines is addressed. When installed, the system must be flexible and suitable for inexperienced operators. The initial development of data acquisition and interpretive methods and the provision of a 'signature' data base for Adour and RB199 engines are described. Important aspects are the combination of engineering understanding, operator experience, and where necessary detailed strip and inspection of problem engines. Although orientated towards military aeroengine practices, the experience and methodology apply to any diagnostic situation. ESA

N92-34236*# General Motors Corp., Indianapolis, IN. Gas Turbine Div.
COOLED HIGH-TEMPERATURE RADIAL TURBINE PROGRAM 2 Final Report
Philip H. Snyder May 1991 95 p
(Contract NAS3-24230; RTOP 505-62-OK; RTOP 505-68-10)
(NASA-CR-189122; NAS 1.26:189122; EDR-15982; USAAVSCOM-TR-92-C-010) Avail: CASI HC A05/MF A01

The objective of this program was the design and fabrication of a air-cooled high-temperature radial turbine (HTRT) intended for experimental evaluation in a warm turbine test facility at the LeRC. The rotor and vane were designed to be tested as a scaled version (rotor diameter of 14.4 inches diameter) of a 8.021 inch diameter rotor designed to be capable of operating with a rotor inlet temperature (RIT) of 2300 F, a nominal mass flow of 4.56 lbm/sec, a work level of equal or greater than 187 Btu/lbm, and efficiency of 86 percent or greater. The rotor was also evaluated to determine it's feasibility to operate at 2500 F RIT. The rotor design conformed to the rotor blade flow path specified by NASA for compatibility with their test equipment. Fabrication was accomplished on three rotors, a bladeless rotor, a solid rotor, and an air-cooled rotor. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N92-33536*# Princeton Univ., NJ.
ON THE CALCULATION OF THE RESPONSE OF HELICOPTERS TO CONTROL INPUTS
H. C. Curtiss, Jr. 24 Sep. 1992 21 p Presented at the 18th European Rotorcraft Forum, Avignon, France, 14-17 Sep. 1992
(Grant NAG2-561)
(NASA-CR-190812; NAS 1.26:190812; Paper-F07) Avail: CASI HC A03/MF A01

In the past few years, a number of studies have provided accurate flight test data for the control response of single rotor helicopters over a wide frequency range. These measured responses have been compared to theory in a number of studies. Various differences between theory and experiment appear in all of these studies. Some of these differences are examined. A quantitative explanation of one prominent difference associated with the contribution of the lag degree of freedom is provided. Areas for further investigation are suggested. The discussion is directed towards articulated rotor helicopters. Flight test data from the UH-60, CH-53, and AH-64 helicopters, much of it taken for the express purpose of evaluating the control response, correlation with theory, and the use of parameter identification methods, is considered. Results for flight conditions near hover are emphasized. Author

N92-33537*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SIMULATION MODEL OF A TWIN-TAIL, HIGH PERFORMANCE AIRPLANE
Carey S. Buttrill, P. Douglas Arbuckle, and Keith D. Hoffler (Vigyan Research Associates, Inc., Hampton, VA.) Jul. 1992 180 p
(Contract NAS1-18585; RTOP 505-64-30-01)
(NASA-TM-107601; NAS 1.15:107601) Avail: CASI HC A09/MF A02

The mathematical model and associated computer program to simulate a twin-tailed high performance fighter airplane (McDonnell Douglas F/A-18) are described. The simulation program is written in the Advanced Continuous Simulation Language. The simulation math model includes the nonlinear six degree-of-freedom rigid-body equations, an engine model, sensors, and first order actuators with rate and position limiting. A simplified form of the F/A-18 digital control laws (version 8.3.3) are implemented. The simulated control law includes only inner loop augmentation in the up and away flight mode. The aerodynamic forces and moments are calculated from a wind-tunnel-derived database using table look-ups with linear interpolation. The aerodynamic database has an angle-of-attack range of -10 to +90 and a sideslip range of -20 to +20 degrees. The effects of elastic deformation are incorporated in a quasi-static-elastic manner. Elastic degrees of freedom are not actively simulated. In the engine model, the throttle-commanded steady-state thrust level and the dynamic response characteristics of the engine are based on airflow rate as determined from a table look-up. Afterburner dynamics are switched in at a threshold based on the engine airflow and commanded thrust. Author

N92-34107*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PILOTED EVALUATION OF AN INTEGRATED PROPULSION AND FLIGHT CONTROL SIMULATOR
Michelle M. Bright and Donald L. Simon (Army Aviation Systems Command, Cleveland, OH.) Aug. 1992 13 p Proposed for presentation at the Flight Simulation Technologies Conference and Exhibit, Hilton Head, SC, 24-26 Aug. 1992; sponsored by AIAA
(RTOP 505-62-50)
(NASA-TM-105797; E-7227; NAS 1.15:105797; AVSCOM-TR-92-C-028) Copyright Avail: CASI HC A03/MF A01

A piloted evaluation of the integrated flight and propulsion control simulator for advanced integrated propulsion and airframe control design is described. The evaluation will cover control effector gains and deadbands, control effectiveness and control authority, and heads up display functionality. For this evaluation the flight simulator is configured for transition flight using an advanced Short Take-Off and Vertical Landing fighter aircraft model, a simplified high-bypass turbofan engine model, fighter cockpit displays, and pilot effectors. The piloted tasks used for rating displays and control effector gains are described. Pilot comments and simulation results confirm that the display symbology and control gains are very adequate for the transition flight task. Additionally, it is demonstrated that this small-scale, fixed base flight simulator facility can adequately perform a real time, piloted control evaluation. Author

N92-34131# Department of the Navy, Washington, DC.
IMPROVED ARTICULATED FIN/WING CONTROL SYSTEM STATEMENT OF GOVERNMENT INTERESTS Patent Application
Charles H. Beauchamp, inventor (to Navy), Manual Cincotta, inventor (to Navy), Anthony Raffa, inventor (to Navy), and Benoit Gauthier, inventor (to Navy) 8 Nov. 1991 17 p
(AD-D015268; US-Patent-Appl-SN-790607; Navy-Case-73152)
Avail: CASI HC A03/MF A01

An articulated control surface is provided for hydrodynamic control utilizing a moldable control surface. The central surface is shaped by contracting and elongating wire bundles fabricated with shape-memory alloys located in an adjacent cooling chamber. The shape-memory alloys contract when heated via an applied electric current and elongate when cooled, i.e., the electric current is removed. A pair of wire bundles is anchored inside the cooling chamber. Each bundle is routed over several pulleys in such a manner that a lateral movement is produced at the actuator end of the wire. A pair of bundles act in opposition to maintain dynamic tension at the actuator end. Cooling flow to opposing wire bundles is controlled independently to enhance response time and reduce power requirements. The actuator is a post extending from the cooling chamber to the trailing edge structure of the control surface. GRA

N92-34161# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO FLUTTER OF WINGED AIRCRAFT, VOLUME 2
1992 501 p Lecture series held in Rhode-Saint-Genese, Belgium, 9-13 Dec. 1991
(VKI-LS-1992-01-Vol-2; ETN-92-92163) Avail: CASI HC A22/MF A04

Papers on the following topics are presented: elementary flutter analysis; flight flutter testing; the design, manufacture, and ground testing of flutter models; aeroelasticity of bluff bodies; unsteady wind tunnel tests; flutter in transonic flight regime; and flutter analyses using high speed computers for large aircraft and aerodynamic procedures. The papers are from the second volume of a two volume set. For individual titles, see N92-34162 through N92-34169.

N92-34162# Manchester Univ. (England). Dept. of Engineering.
ELEMENTARY FLUTTER ANALYSIS
Jan R. Wright *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 47 p (For primary document see N92-34161 24-08)
Avail: CASI HC A03/MF A04

Basic ideas and common misunderstandings of wing flexure-torsion flutter are clarified. The following topics are addressed: an understanding of the physics of wing flexure-torsion flutter through a number of specific examples; an examination of the energy interpretation of the physics of flutter, indicating its limited usefulness; a graphical representation to assess the contribution of various parameters to flutter onset; subcritical response below the critical flutter speed; and some practical wing flutter considerations. ESA

N92-34163# Manchester Univ. (England). Dept. of Engineering.
FLIGHT FLUTTER TESTING
Jan R. Wright *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 185 p (For primary document see N92-34161 24-08)
Avail: CASI HC A09/MF A04

Flight flutter testing is explained in regard to the airworthiness requirements, the subcritical clearance philosophy, the excitation device used, the excitation signal types, the instrumentation/recording, the signal processing, and the system identification methods used for analyzing the flight data. Some practical problems and future needs are considered. A bibliography is included but it is not exhaustive, either historically or internationally; some modal identification references are added since there are many parallels between flight and ground vibration testing. ESA

N92-34164# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FLUTTER MODELS: THEIR DESIGN, MANUFACTURE, AND GROUND TESTING
F. Dupriez *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 25 p (For primary document see N92-34161 24-08)
Avail: CASI HC A03/MF A04

Dynamically similar models (similar to the aircraft in their geometric, elastics, and mass representations) are used for the general investigation of flutter. However, there are similarity defects and rules, and these are discussed. A system for suspending the model in the wind tunnel is described. The flutter model design and construction technologies used are discussed. Static and dynamic tests are considered. ESA

N92-34165# Johns Hopkins Univ., Baltimore, MD. Dept. of Civil Engineering.
AEROELASTICITY OF BLUFF BODIES
Robert H. Scanlan *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 76 p (For primary document see N92-34161 24-08)
Avail: CASI HC A05/MF A04

Low speed fluid structure interactive phenomena, principally as brought under observation by practical problems and circumstances in the civil engineering field, are addressed. The following phenomena are examined: bridge flutter, torsional divergence, wake and wind rain galloping, and stall flutter. Some general observations in flow induced observations are made. Vortex shedding is also addressed. ESA

N92-34166# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY WIND TUNNEL TESTS
P. M. Hutin *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 38 p (For primary document see N92-34161 24-08)
Avail: CASI HC A03/MF A04

Various measurements concerning unsteady aerodynamics are discussed. The unsteady pressure measurements in a wing, used as points of comparison for the unsteady aerodynamic computation methods on which flutter computations are based, are mentioned and wind tunnel tests of flutter are analyzed. Various measurements, their use, and the safety systems are discussed to give an overview of what can be done in this area. ESA

N92-34167# Boeing Commercial Airplane Co., Seattle, WA. Structures Research.
FLUTTER IN THE TRANSONIC FLIGHT REGIME
Warren H. Weatherill *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 50 p (For primary document see N92-34161 24-08)
Avail: CASI HC A03/MF A04

Characteristics of the transonic flutter boundary and the corresponding unsteady aerodynamics are discussed. Three different types of shock motion are discussed together with an interesting characteristic of unsteady pressure distribution, the presence of a 'pulse' or 'blip', which is directly related to the movement of the shock. The characteristics of the transonic flutter boundary and associated unsteady aerodynamics are illustrated through a typical section, two dimensional flutter example. The effects of flutter in attached and separated flow are considered. The calculation of unsteady airload, for use in transonic flutter analyses is discussed, and a procedure which is representative of the current state of the art is described. This procedure is the CAP-TSD (Computational Aeroelastic Program-Transonic Small Disturbance) program which is based on the transonic small disturbance equation for the velocity potential. ESA

N92-34168# Boeing Commercial Airplane Co., Seattle, WA. Structures Research.
FLUTTER ANALYSES USING HIGH SPEED COMPUTERS. PART 1: FLUTTER ANALYSES FOR LARGE AIRCRAFT
Warren H. Weatherill *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 35 p (For primary document see N92-34161 24-08)
Avail: CASI HC A03/MF A04

Characteristics of flutter analyses pertaining to large aircraft are discussed. A description of the physical system presented by

the equations of motion is given. Typically, the equations of motion are written to describe a simplified version of the actual physical system being analyzed. These simplifications result from a combination of limitations in available modeling procedures as well as computer cost limitations. A description of a simplified physical model to be represented by the equations of motion, in the present case a large transport type aircraft, is given. The general nature of the terms of the equations is discussed with respect to the number of unknowns and important characteristics with respect to the flutter problem. Solution procedures are examined and some comments about the nature of flutter boundaries in general are made. ESA

N92-34169# Boeing Commercial Airplane Co., Seattle, WA. Structures Research.
FLUTTER ANALYSES USING HIGH SPEED COMPUTERS. PART 2: AERODYNAMIC PROCEDURES
Warren H. Weatherill *In* VKI, Introduction to Flutter of Winged Aircraft, Volume 2 1992 36 p (For primary document see N92-34161 24-08)
Avail: CASI HC A03/MF A04

The doublet lattice procedure is an aerodynamic procedure for use in flutter analyses with high speed computers. The nature of the doublet lattice procedure and how it is used with flutter equations is introduced. Means of correcting the doublet lattice using empirical data to account for physical phenomena that are not modeled in the original formulation are described, and two examples are discussed. ESA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N92-33398# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD.
COST/BENEFIT ANALYSIS OF THE AH-64 (APACHE) HELICOPTER AUTOMATED TEST EQUIPMENT (ATE) Final Report
Scott P. Pridgeon, Ann T. Vogt, and Larry P. Waggoner Jan. 1992 108 p
(AD-A252909; AMSAA-TR-519) Avail: CASI HC A06/MF A02

A cost/benefit analysis was conducted to evaluate the Automated Test Equipment (ATE) requirements to provide fault detection capability for electronic components for the support of the AH-64 Apache helicopter. The Apache currently uses a dedicated Electronic Equipment Test Facility (EETF) to provide this capability. It is Army policy, however, that the Integrated family of Test Equipment (IFTE) be the Army standard ATE for providing this capability. Due to a funding shortfall for IFTE and the current fielding of an upgrade to the EETF computer, the Commanding General of AMC requested that an economic analysis be conducted to compare EETF versus IFTE for the support of the Apache. A life cycle cost-analysis was conducted in which alternatives were compared over a 20-year time frame. The analysis compares the costs, benefits and feasibility of continuing to use EETF versus various options for transitioning to IFTE in support of Apache. In summary, the life cycle costs for EETF are significantly less than IFTE. While the sustainment costs for IFTE are less than EETF, they do not offset the higher acquisition costs. GRA

N92-33434# Federal Aviation Administration, Washington, DC.
ACCOMPLISHMENTS UNDER THE AIRPORT IMPROVEMENT PROGRAM, FY 1991 Annual Report No. 10
Jean Hetsko 1991 124 p
(AD-A253046; DOT/FAA/RP-92-3) Avail: CASI HC A06/MF A02

Section 521 of the Airport and Airway Improvement Act of 1982 (Public Law 97-248) requires that the Secretary of Transportation submit an annual report to Congress describing the accomplishments of the Airport grant program. This report covers activities for the fiscal year ending September 30, 1991. Accomplishments and the Airport Improvement Program are reported. GRA

N92-33826*# Alabama Univ., Huntsville. Dept. of Chemical and Materials Engineering.
HIGH TEMPERATURE AIRCRAFT RESEARCH FURNACE FACILITIES Final Report
James E. Smith, Jr. and John L. Cashon Aug. 1992 109 p
(Contract NAS8-36955)
(NASA-CR-184384; NAS 1.26:184384) Avail: CASI HC A06/MF A02

Focus is on the design, fabrication, and development of the High Temperature Aircraft Research Furnace Facilities (HTARFF). The HTARFF was developed to process electrically conductive materials with high melting points in a low gravity environment. The basic principle of operation is to accurately translate a high temperature arc-plasma gas front as it orbits around a cylindrical sample, thereby making it possible to precisely traverse the entire surface of a sample. The furnace utilizes the gas-tungsten-arc-welding (GTAW) process, also commonly referred to as Tungsten-Inert-Gas (TIG). The HTARFF was developed to further research efforts in the areas of directional solidification, float-zone processing, welding in a low-gravity environment, and segregation effects in metals. The furnace is intended for use aboard the NASA-JSC Reduced Gravity Program KC-135A Aircraft. Author

N92-34141*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
EXPERIMENTAL STUDY OF PERFORMANCE DEGRADATION OF A ROTATING SYSTEM IN THE NASA LEWIS RC ICING TUNNEL Final Report, 21 Feb. 1989 - 28 Jun. 1991
Kenneth Korkan 3 Sep. 1992 63 p
(Contract NCC3-132)
(NASA-CR-190684; NAS 1.26:190684) Avail: CASI HC A04/MF A01

The Helicopter Icing Consortium (HIC) conducted one of the first U.S. tests of a heavily instrumented model in the controlled environment of a refrigerated tunnel. In the Icing Research Tunnel (IRT) at NASA LeRC, ice was accreted on the main rotor blade of the BMTR-1 Sikorsky model helicopter under a variety of environmental conditions, such that liquid water content (LWC) and volume mean droplet diameter (VMD) ranges reflected the Federal Aviation Agency and Department of Defence icing condition envelopes. This report gives the correlated results of the data provided by NASA LeRC. The method of statistical analysis is discussed. Lift, thrust, and torque coefficients are presented as a function of icing time, as correlated with changes in ambient temperature, LWC, and VMD. The physical significance of these forces is discussed. Author

N92-34213*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PILOT-PRESSURE PROBE FOR MEASURING PRESSURE IN A HYPERSONIC WIND TUNNEL Patent Application
George C. Ashby, Jr., inventor (to NASA) 16 Jul. 1992 11 p
(NASA-Case-LAR-14232-1; NAS 1.71:LAR-14232-1;
US-Patent-Appl-SN-914905) Avail: CASI HC A03/MF A01

A device for measuring pressure in high-velocity fluid streams in wind tunnels in which a transducer is mounted within a housing located within the wind tunnel and separated by a relatively short distance from a pitot tube in the free stream area of the wind tunnel is presented. Because the tunnel must be heated to a very high temperature, the transducer is water cooled. Additionally, the construction of this pressure probe is such that the pitot tube may move rotationally or radially relative to the transducer housing. NASA

N92-34222*# Old Dominion Univ., Norfolk, VA. Dept. of Mechanical Engineering and Mechanics.
DYNAMICS AND CONTROL OF A FIVE DEGREE-OF-FREEDOM MAGNETIC SUSPENSION SYSTEM
Thesis Progress Report, 1 Nov. 1991 - 30 Apr. 1992
Anwar Mohammed Haj and Colin P. Britcher Jun. 1992 91 p (Grant NAG1-1056)
(NASA-CR-190567; NAS 1.26:190567) Avail: CASI HC A05/MF A01

A large-gap magnetic suspension system with five degrees-of-freedom is presented. The system is multi-input/multi-output with coupling between degrees-of-freedom. Simulation was performed on this multi degree-of-freedom system in order to control each degree-of-freedom separately. Two types of controllers are considered by adding white noise to a single degree-of-freedom system in order to test their behavior and determine which is the best choice for the system. The responses of the system are produced in continuous and discrete time where a sample interval and delay time was introduced. Using these responses, a comparison between each degree-of-freedom was made and the maximum value of the delay time was determined. Author

N92-34247# Resource International, Inc., Westerville, OH.
CRITERIA FOR USE OF SEAL COATS ON AIRPORT PAVEMENTS Final Report
L. Saraf Chhote, Kamran Majidzadeh, and V. R. Kumar Aug. 1992 121 p
(Contract DTFA01-90-C-00029)
(DOT/FAA/RD-92/18) Avail: CASI HC A06/MF A02

Seal coats are generally used to protect the pavement surfaces from oxidation and ingress of water to layers below. Additionally, seal coats on airport pavements are expected to protect the pavement from the potential damage of fuel spillage. This report describes the results of literature search conducted for this study. It also describes the information gathered from visits to eight airport sites located throughout the U.S. Samples of seal coat materials obtained from five airport sites were tested in the laboratory to determine their performance characteristics. Also, the characteristics of asphalt and coal tar seal coat mixes were tested under dry and wet freeze-thaw cycling to determine the effect of wet freeze-thaw cycling on cracking of sixteen different mixes. The results of all these tests are included in this report along with a summary and conclusion, and a list of recommendations. Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N92-33309*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
THIRD SEI TECHNICAL INTERCHANGE: PROCEEDINGS
1992 601 p Meeting held in Houston, TX, 5-6 May 1992; sponsored by NASA. Johnson Space Center and Houston Univ., Clear Lake
(NASA-TM-107974; NAS 1.15:107974) Avail: CASI HC A99/MF A05

Given here are the proceedings of the 3rd Space Exploration Initiative (SEI) Technical Interchange. Topics covered include the First Lunar Outpost (FLO), the Lunar Resource Mapper, lunar rovers, lunar habitat concepts, lunar shelter construction analysis, thermoelectric nuclear power systems for SEI, cryogenic storage, a space network for lunar communications, the moon as a solar power satellite, and off-the-shelf avionics for future SEI missions. For individual titles, see N92-33310 through N92-33349.

N92-33310*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SEI REFERENCE MISSION
Dwayne Weary *In its* Third SEI Technical Interchange: Proceedings 1992 p 1-8 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

Information is given in viewgraph form on the Space Exploration Initiative (SEI). The goal of the reference mission is to expand the human presence to the moon and Mars in order to enhance our understanding of the universe, to seek terrestrial benefits from this exploration, and to establish the beginnings of a sustainable spacefaring civilization. Topics covered here include a phased definition of initial programmatic milestones and follow-on capabilities, near-term mission strategy, a lunar mission timeline, and a Mars mission timeline. Author

N92-33311*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
LUNAR RESOURCE MAPPER/LUNAR GEODETIC SCOUT PROGRAM STATUS **c91**
Mike Conley *In its* Third SEI Technical Interchange: Proceedings 1992 p 9-15 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

Information is given in viewgraph form on the Lunar Resource Mapper/Lunar Geodetic Scout (LRM/LGS) program status. Topics covered include the LEXWG Lunar Observer science measurement priorities, space exploration initiative priorities, the question of why a lunar orbiting mission is attractive to the Space Exploration Initiative (SEI), instrument selection, major milestones, and the organization of the LRM/LGS Program Office. Author

N92-33312*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
ARTEMIS: COMMON LUNAR LANDER PROJECT STATUS
Stephen Bailey *In its* Third SEI Technical Interchange: Proceedings 1992 p 16-39 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Information is given in viewgraph form on the Artemis Common Lunar Lander project status. The plans are to start the Space Exploration Initiative (SEI) with lunar robotic missions that can demonstrate the NASA cultural change and provide a catalyst for human exploration of the moon and Mars. The Artemis Common Lunar Lander Concept developed by the Johnson Space Center (JSC) has been accepted as the centerpiece of this lunar robotic exploration program. Topics covered include the anticipated program structure, a concept overview, lander value as a function of payload mass, the approach of the JSC in-house study, an example launch vehicle packaging concept, and the use of the Delta 2 launch vehicle. Author

N92-33313*# Lunar and Planetary Inst., Houston, TX.
SCIENCE THEMES FOR EARLY ROBOTIC MISSIONS: LPI WORKSHOPS
Paul D. Spudis *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 40-47 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

Information is given in viewgraph form on science themes for early robotic missions that were developed during workshops. Topics covered include lunar resources, lunar terrain, lunar gravity, the lunar surface lander, and the Lunar Geoscience Explorer. Author

N92-33314*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
ARTEMIS PROGRAM: ROVER/MOBILITY SYSTEMS WORKSHOP RESULTS
Dave Weaver *In its* Third SEI Technical Interchange: Proceedings 1992 p 49-57 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

Information is given in viewgraph form on the Artemis Program Rover/Mobility Systems Workshop results. Topics covered include an outpost site survey and resource assessment for Mare

Tranquillitatis (15 n, 22 E). Viable mobility systems appear to be capable of supporting a 1997 launch. Achieving the defined mission objectives within a 65 kg payload appears to be possible, although with limited capability. Author

N92-33315*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
FIRST LUNAR OUTPOST: MISSION OVERVIEW
Kent Joosten *In its* Third SEI Technical Interchange: Proceedings 1992 p 59-74 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Information is given in viewgraph form on the First Lunar Outpost. Topics covered include the program strategy, a mission overview, and evolution options. It is noted in the mission overview that each flight to the moon requires a single launch, greatly simplifying the operations that would be required in a multiple launch scenario. A one-way cargo mission will precede the arrival of the first crew. The crew will perform both extravehicular activity and intra-vehicular activity in the areas of surface exploration and science activities. After the mission is complete, the crew will return to earth. Author

N92-33316*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SCIENCE AND IN SITU RESOURCES UTILIZATION (ISRU): DESIGN REFERENCE MISSION FOR THE FIRST LUNAR OUTPOST
David S. McKay *In its* Third SEI Technical Interchange: Proceedings 1992 p 75-115 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Information is given in viewgraph form on the science and in situ resources utilization (ISRU) for the design reference mission for the First Lunar Outpost (FLO). Topics covered include requirements and themes, the general approach, science payloads, trade studies, science evolution, and present and future activities. Author

N92-33317*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SPACE TRANSPORTATION c16
Ron Kahl *In its* Third SEI Technical Interchange: Proceedings 1992 p 116-138 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Information is given in viewgraph form on the First Lunar Outpost (FLO), the lunar launch vehicle, the Lunar Lander, design features of the return stage, mass estimates for the cargo mission and the piloted mission, and extravehicular activities. Author

N92-33318*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
FIRST LUNAR OUTPOST: LUNAR HABITAT CONCEPTS AND ISSUES
Molly Elrod *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 139-150 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Information is given in viewgraph form on concepts and issues relative to the lunar habitat of the First Lunar Outpost (FLO). The initial design is for a mission capability for a group of four on a lunar stay of 45 days (lunar day-night-day). Existing hardware is used where practical. The specific goals include reuse every six months, provision of solar flare protection, manned extravehicular activities, operation anywhere on the lunar surface, access to all hardware to provide for infinite life, and a design that allows for growth. Author

N92-33319*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
FIRST LUNAR OUTPOST EARTH TO ORBIT CONCEPTS AND ISSUES
Gene Austin *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 150-160 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The topics are presented in viewgraph form and include the following: (1) mission design choices - implications to a heavy-lift launch vehicle (HLLV); (2) Space Exploration Initiative (SEI) reference launch vehicles; (3) lunar mission profile; (4) Saturn 5 derived HLLV with 2 liquid oxygen (LOX)/RP boosters; (5) National Launch System (NLS) derived HLLV with 4 LOX/RP boosters; (6) first lunar outpost mission performance; (7) future trade studies; and (8) the first lunar outpost definition process. Author

N92-33320*# Houston Univ., Clear Lake, TX. Studies of the Future.
ORGANIZATIONAL CHANGE: INCENTIVES AND RESISTANCE
Peter C. Bishop *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 161-177 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Topics concerning Space Exploration Initiative technical interchange are presented in viewgraph form and include the following: models of change, elements of the current period, the signs of change, leaders' contribution, paradigms - our worldview, paradigm change, the effects of revealing paradigms, a checklist for change, and organizational control. Author

N92-33321*# Defense Systems Management School, Fort Belvoir, VA.
ACQUISITION STREAMLINING: A CULTURAL CHANGE
Jesse Stewart *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 178-205 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The topics are presented in viewgraph form and include the following: the defense systems management college, educational philosophy, the defense acquisition environment, streamlining initiatives, organizational streamlining types, defense law review, law review purpose, law review objectives, the Public Law Pilot Program, and cultural change. Author

N92-33322*# Lockheed Missiles and Space Co., Sunnyvale, CA.
COOPERATION IN SPACE
A. Guastaferro *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 212-227 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The topics from the Technical Interchange Meeting for the NASA Space Exploration Initiative are presented in viewgraph form. The objective is to share a perspective of a cost-effective cooperation management structure of NASA and industry as we move towards the 21st century and the national commitment to continue our exploration in space with humans. Some of the topics covered include a personal background, today's culture, new approaches, congressional oversight, programmatic impact, and recommendations. Author

N92-33323*# Lockheed Missiles and Space Co., Sunnyvale, CA.
SKUNK WORKS TYPE APPROACH FOR F-SAT
Gary F. Turner *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 228-238 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The topics are presented in viewgraph form and include the following: the F-SAT Program, the classic program organization, design/configuration management, procurement/material, manufacturing, quality assurance, the facility, and personnel management. Author

N92-33324*# McDonnell-Douglas Space Systems Co., Huntington Beach, CA.
PROJECT MANAGEMENT LESSONS LEARNED ON SDIO'S DELTA STAR AND SINGLE STAGE ROCKET TECHNOLOGY PROGRAMS
Paul L. Klevatt *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 239-261 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The topics are presented in viewgraph form and include the following: a Delta Star (Delta 183) Program Overview, lessons learned, and rapid prototyping and the Single Stage Rocket Technology (SSRT) Program. The basic objective of the Strategic Defense Initiative Programs are to quickly reduce key uncertainties to a manageable range of parameters and solutions, and to yield results applicable to focusing subsequent research dollars on high payoff areas. Author

N92-33325*# Colorado Univ., Boulder. Center for Space Construction.
FIRST LUNAR OUTPOST CONSTRUCTION ANALYSIS
Chris Grasso, John Happel, Brent Helleckson, Steve Jolly, Martin Mikulas, Jane Pavlich, Renjeng Su, and Rob Taylor *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 274-283 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

The topics are presented in viewgraph form and include the following: the construction problem with the radiation shielding; preliminary construction analysis; the feasibility analysis of a small lunar tractor-scraper vehicle (LTSV); the scraper preliminary power analysis; LTSV feasibility; a small lunar dragline crane (LDC); a lunar superstructure arch (LSA); and the feasibility analysis of a lunar self-offloading lander crane. Author

N92-33326*# Ad Astra Ltd., Santa Fe, NM.
DOME CITIES FOR EXTREME ENVIRONMENTS
Raymond S. Leonard and Milton Schwartz (Schwartz, Milton Architects, Santa Fe, NM) *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 284-302 Revised (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Extreme environments whether they be the frigid nights of the polar regions, the burning sands of the desert, or the harsh environment of space pose interesting challenges to the architect, the engineer, and the constructor in their efforts to create habitats for mankind. In space, the goals are to provide radiation protection while also providing an aesthetic living environment for long duration missions. Because of the need to provide both radiation protection and options for expansion of base facilities, a unique structural system which separates the radiation protection systems from the pressure envelope of the habitats was created. The system uses cable networks in a tensioned structural system, which supports the lunar regolith used for shielding above the facilities. The system is modular, easily expandable, and simple to construct. Additional innovations include the use of rock melting perpetrators for piles and anchoring deadmen, and various sized craters to provide side shielding. The reflective properties of the fabric used in the membrane are utilized to provide diffuse illumination. The use of craters along with the suspended shielding allows the dome to be utilized in fashions similar to those proposed by various designers unaware of the Moon's hostile radiation environment. Additional topics addressed deal with construction techniques for large domes, i.e., on the order of 100's to 1000's of meters, thermal control, the integration of tertiary water treatment schemes with architectural design, human factors, and its implications for the design of habitats for long term use in extreme environments. Author

N92-33327*# New Mexico Univ., Albuquerque. Engineering Research Inst.
A CENTER FOR EXTRATERRESTRIAL ENGINEERING AND CONSTRUCTION (CETEC) **c31**
Gerald G. Leigh *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 303-316 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

A group of knowledgeable scientists and engineers in New Mexico has recognized the need for such a testing capability and has proposed a project to evelop an extraterrestrial surface simulation facility. A group of universities, national laboratories, and private industrial firms is proposing to establish a Center for Extraterrestrial Engineering and Construction (CETEC) and to develop large extraterrestrial surface simulation facilities in which this needed testing can be realistically performed. The CETEC is envisioned to be both a center of knowledge and data regarding engineering, construction, mining, and material process operations on extraterrestrial bodies and a set of extraterrestrial surface simulation facilities. The primary CETEC facility is proposed to be a large domed building made of steel reinforced concrete with more than one acre of test floor area covered with several feet of simulated lunar soil and dust. Various aspects of the project are presented in viewgraph form. Author

N92-33328*# General Dynamics Corp., San Diego, CA. Space Systems Div.
CRYOGENIC STORAGE TECHNOLOGY READINESS FOR FIRST LUNAR OUTPOST **c31**
John R. Schuster *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 317-335 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The topics are presented in viewgraph form and include the following: an assessment of cryogenic storage technology; cryogenic boiloff predictions; Space Shuttle/Centaur thermodynamic vent system; zero-g thermodynamic vent system; heat exchanger/mixer pump module; the thick multilayer insulation (MLI) development program; blanket geometry concept evaluations; four-inch thick MLI system on 1/4-scale test tank; combined environments of vibration, acceleration, and temperature testing (CEVAT); Centaur fixed foam insulation; insulation system design; and fixed foam on operational Atlas 2. Author

N92-33329*# Houston Univ., TX. Inst. of Space Systems Operations.
RELATION OF THE LUNAR POWER SYSTEM TO THE SEI PROGRAM AND TO LANDERS **c31**
David R. Criswell and Robert D. Waldron (Waldron, Robert D., Hacienda Heights, CA) *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 347-363 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The people of Earth will need more than 20,000 billion watts (GWe) of electric power by 2050 for a high level of prosperity. Power needs in the 22nd Century could exceed 100,000 GWe. By 2100 the total quantity of thermal energy used could fully deplete the known inventory (10(exp 7) GWt-Y) of all non-renewable sources on Earth except for deuterium and hydrogen for use in proposed fusion reactors. The labor, capital, and mass of power plants required to produce 1 GWe-Y of energy from present-day power plants is summarized. Fossil and nuclear plants respectively consume 80 to 190 M$ and 12 to 48 M$ of fuel per GWe-Y. The Lunar Power System (LPS) uses solar power bases on the moon to beam electric power to Earth. The LPS in the figure supplies load-following power to rectennas on Earth. Additional solar power conversion units are located across the lunar limb from their respective Earthward transmitting stations. LPS can be augmented by mirrors in polar orbit about the moon. The construction of rectennas on Earth determines the base cost (0.001s$/kWe-H) of LPS power. A manned International Lunar Base (ILB) can accelerate the development of LPS by providing the initial transportation and habitation facilities and base operations. ILB

can greatly reduce up front costs and risks by emplacing a moderate scale LPS (1-100 GWe). LPS can accelerate the development of the ILB by providing greater funding than is reasonable to expect for purely scientific research. An international ILB/LPS program can foster world trust and prosperity. Author

N92-33330*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
DYNAMIC ISOTOPE POWER SYSTEMS FOR FLO **c44**
Maribeth E. Hunt *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 364-372 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

A comparison of candidate systems for FLO is presented. Free space missions within approximately 1.5 au will be photovoltaic/battery or solar dynamic and are not considered within this study. Additionally, isotope systems (DIPS) are not considered candidate systems for these applications. The study is presented in viewgraph form. Author

N92-33331*# General Electric Co., Philadelphia, PA.
NEAR-TERM THERMOELECTRIC NUCLEAR POWER OPTIONS FOR SEI MISSIONS **c73**
Jerry R. Peterson *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 373-385 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Three different types of thermoelectric nuclear space power systems are discussed. First, the general purpose heat source Radioisotope Thermoelectric Generator (RTG), which was qualified and flown on Galileo/Ulysses and is in development for Cassini, is discussed. Second, the modular RTG, which is undergoing life verification, is discussed. Finally, the SP-100 is discussed. The information is presented in viewgraph form. Author

N92-33332*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
RF FEL FOR POWER BEAMING **c36**
Robert Burke *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 386-405 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The laser device components associated with operating a radio frequency-free electron laser (RF-FEL) for beaming power from Earth were designed and tested. Analysis of the power beaming system requirements reveals that the FEL, identified by NASA as the laser of choice, is the major subsystem requiring demonstration before proceeding further in proving the efficacy of laser power beaming. Rocketdyne has identified a series of low cost, low risk demonstrations which proceed sequentially, as follows: (1) a 1 kW proof-of-principle demonstration; (2) a 150 kW demonstration of beaming power to a satellite; and (3) a MW class demonstration of Earth to lunar surface power transmission. This sequence of events can be completed in 5.5 years at a cost of $188M, with key milestones each year. Author

N92-33333*# Optical Energy Technologies, Inc., Stamford, CT.
THE MOON AS A SOLAR POWER SATELLITE **c44**
Gerald Falbel *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 406-420 (For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

A modified version of the Satellite Solar Power System (SPS) is proposed. The original SPS was conceived by Dr. Peter Glaser of MIT in 1968, as a series of large, photovoltaic solar collectors orbiting at geosynchronous altitude, and converting and beaming the collected solar power to the earth surface using microwave energy (which can pass through cloud cover). This system has been studied extensively in the past. The modified version of the SPS will make use of the moon as the 'satellite'. Author

N92-33334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FAST TRACK LUNAR NTR SYSTEMS ASSESSMENT FOR THE FIRST LUNAR OUTPOST AND ITS EVOLVABILITY TO MARS **c31**
Stanley K. Borowski and Stephen W. Alexander *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 421-436 (For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

The objectives of the 'fast track' lunar Nuclear Thermal Rocket (NTR) analysis are to quantify necessary engine/stage characteristics to perform NASA's 'First Lunar Outpost' scenario and to assess the potential for evolution to Mars mission applications. By developing NTR/stage technologies for use in NASA's 'First Lunar Outpost' scenario, NASA will make a major down payment on the key components needed for the follow-on Mars Space Transportation System. A faster, cheaper approach to overall lunar/Mars exploration is expected. Author

N92-33335*# Los Alamos National Lab., NM.
NUCLEAR THERMAL ROCKET BY 2000: A DOE PERSPECTIVE **c73**
Steven D. Howe and Marland Stanley (Idaho National Engineering Lab., Idaho Falls.) *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 437-444 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

It is asserted that a Nuclear Propulsion Space Transportation System is required for the Manned Mars Mission. Additionally, it is felt that a Nuclear Propulsion Space Transportation System can support a wide variety of future space missions, including lunar base implementation and support. The Rover/NERVA program demonstrated that a safe, reliable Nuclear Thermal Rocket (NTR) can be developed and operated for sufficient run times, at desirable temperatures, and with multiple restarts. The discussion is presented in viewgraph form. Author

N92-33336*# GenCorp Aerojet, Sacramento, CA. Propulsion Div.
SPACE DEFENSE INITIATIVE TECHNOLOGIES AND HARDWARE CAN HELP RESOLVE CERTAIN SPACE EXPLORATION INITIATIVE WEIGHT AND PERFORMANCE ISSUES
Bryce Relmer *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 445-459 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The use of Space Defense Initiative (SDI) technologies and hardware in solving Space Exploration Initiative (SEI) problems is presented. The topics discussed include the following: Aerojet programs, SDI's technical focus, SDI technology weight savings, realized benefits, composite technologies, the Advanced Liquid Axial Stage (ALAS), propellant and pressurant tanks, lightweight engines, high performance helium tanks, hoop and helical fibers, ALAS's advanced carbon composite structure, and CLF5 performance issues. The discussion is presented in viewgraph form. Author

N92-33337*# TRW, Inc., Redondo Beach, CA. Space and Technology Group.
LOW PRESSURE-HIGH PERFORMANCE BOOSTER ENGINE TECHNOLOGY FOR ULTRA-LOW COST LAUNCH VEHICLES **c20**
Robert L. Sackheim *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 460-470 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Low-cost booster engine technology is discussed. Additionally, coaxial pintle injector technology is discussed. These discussions are presented in viewgraph form. Author

N92-33338*# Mitre Corp., Washington, DC.
FEASIBILITY OF LUNAR COMMUNICATIONS USING THE TDRS 2 **c32**
Michael A. Jordan *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 471-482 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The Space Network's Tracking and Data Relay Satellite (TDRS) 2 geostationary satellite constellation may be capable of providing lunar communication for the Space Exploration Initiative. The geometrical coverage constraints, link budgets, TDRS 2 delivery schedules, and life cycle costs for various Space Network architecture options. Author

N92-33339*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SATWG NETWORKED QUALITY FUNCTION DEPLOYMENT **c62**
Don Brown *In its* Third SEI Technical Interchange: Proceedings 1992 p 483-488 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

The initiative of this work is to develop a cooperative process for continual evolution of an integrated, time phased avionics technology plan that involves customers, technologists, developers, and managers. This will be accomplished by demonstrating a computer network technology to augment the Quality Function Deployment (QFD). All results are presented in viewgraph format. H.A.

N92-33340*# Honeywell, Inc., Minneapolis, MN. Systems and Research Center.
STUDY OBJECTIVES: WILL COMMERCIAL AVIONICS DO THE JOB? IMPROVEMENTS NEEDED? **c06**
Hatem Nasr *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 489-497 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

Improvements in commercial avionics are covered in a viewgraph format. Topics include the following: computer architecture, user requirements, Boeing 777 aircraft, cost effectiveness, and implemention. H.A.

N92-33341*# Boeing Co., Seattle, WA.
COMMON MANNED MODULE **c18**
Dana Andrews *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 498-506 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

An economic analysis examines a reusable single crew module to reduce the cost of Moon to stay exploration by 5 billion dollars. Topics covered in viewgraph format include the following: aerodynamics, weight, runway landing, technology support, and common module reentry requirements. H.A.

N92-33342*# Martin Marietta Corp., Denver, CO.
MULTI STAGE LUNAR LANDER STORABLE VERSUS CRYO PROPULSION **c16**
John R. Hodge *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 507-521 (For primary document see N92-33309 24-12)
(Contract NAS8-37856)
Avail: CASI HC A03/MF A05

Space transfer vehicle concepts and requirements are examined in a viewgraph format. Topics covered include the following: stage interfaces, element design, ascent and descent systems, and performance parameters. H.A.

N92-33343*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
BENEFITS AND TECHNOLOGY READINESS FOR USING CRYOGENIC INSTEAD OF STORABLE PROPELLANTS FOR RETURN MISSION FROM MOON **c28**
David W. Plachta *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 522-539 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Cryogenic requirements are examined for new missions to the moon. A comparison is made with previous moon landings and a technology assessment investigates the new requirements for such missions. All of the material is presented in viewgraph format. H.A.

N92-33344*# Arizona Univ., Tucson. Telerobotics Lab.
PROPOSED LUNAR MISSIONS **c31**
Larry Schooley *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 540-554 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

Three lunar missions are proposed: a 65 kg Artemis payload with an in-situ materials utilization (ISMU) pilot plant; a 65 kg Artemis payload with a lunar resource prospector; and a 200 kg Artemis payload with an integrated oxygen production plant. All material is presented in viewgraph format. H.A.

N92-33345*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
FIRST LUNAR OUTPOST CREW MODULE THERMAL PROTECTION DESIGN SENSITIVITY **c54**
Stan Bouslog (Lockheed Engineering and Sciences Co., Houston, TX.), Bill Rochelle (Lockheed Engineering and Sciences Co., Houston, TX.), Stan Williams (Lockheed Engineering and Sciences Co., Houston, TX.), Joe Caram, Don Curry, Steve Derry, and Matt Ondler *In its* Third SEI Technical Interchange: Proceedings 1992 p 555-569 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

A thermal protection study was conducted on the first lunar outpost (FLO) crew module. The study objectives are as follows: (1) assess effects of vehicle size on aerothermodynamic environment and thermal protection system (TPS) weight; (2) assess effects of lunar-return strategies on aerothermodynamic environment and TPS weight; and (3) assess weight penalty for common TPS design for all lunar-return strategies. All material is covered in viewgraph format. H.A.

N92-33346*# Martin Marietta Corp., Denver, CO.
SPACE HABITATION AND OPERATIONS MODULE (SHOM) **c54**
Ralph Eberhardt *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 570-576 (For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

Viewgraphs present floorplans for a space habitation module. Charts show various human needs in a habitation module and how they are weighted towards individual or group requirements. H.A.

N92-33347*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
EARTH LAND LANDING ALTERNATIVES: LUNAR TRANSPORTATION SYSTEM
Robert Meyerson *In its* Third SEI Technical Interchange: Proceedings 1992 p 577-591 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The objectives of this study are as follows: (1) develop a landing option such that it is a viable trade option for future NASA missions; (2) provide NASA programs with solid technical support in the landing systems area; (3) develop the technical staff; and (4) advance the state of landing systems technology to apply to future NASA missions. All results are presented in viewgraph format. H.A.

N92-33348*# Tracor, Inc., Austin, TX.
PNEUMATICALLY ERECTED RIGID HABITAT **c54**

Bradley Salles *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 592-596 (For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

The pneumatically erected rigid habitat concept consists of a structure based on an overexpanded metal bellows. The basic concept incorporates the advantages of both inflatable and rigid structures. The design and erection detail are presented with viewgraphs. H.A.

N92-33349*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
PLUME INDUCED ENVIRONMENTS ON FUTURE LUNAR MISSION VEHICLES **c37**
Bill Rochelle (Lockheed Engineering and Sciences Co., Houston, TX.), Ruston Hughes (Lockheed Engineering and Sciences Co., Houston, TX.), and Steve Fitzgerald *In its* Third SEI Technical Interchange: Proceedings 1992 p 597-611 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

The objective of this presentation is to identify potential plume heating/impingement problem areas on vehicles used for future lunar missions. This is accomplished by comparison with lunar module plume investigations performed during 1968-1971. All material is presented in viewgraph format. H.A.

N92-33441*# National Aeronautics and Space Administration, Washington, DC.
THE LIGHT OF A NEW AGE
Daniel S. Goldin 1992 7 p Presented at the Association of Space Explorers, 24 Aug. 1992, Washington, DC
(NASA-TM-107985; NAS 1.15:107985) Avail: CASI HC A02/MF A01

Given here is the address of NASA Administrator Daniel S. Goldin to the Association of Space Explorers. Mr. Goldin's remarks are on the topic of why we should go to Mars, a subject he approaches by first answering the question, What would it mean if we decided today not to go to Mars? After a discussion of the meaning of Columbus' voyage to America, he answers the question by saying that if we decide not to go to Mars, our generation will truly achieve a first in human history - we will be the first to stop at a frontier. After noting that the need to explore is intrinsic to life itself, Mr. Goldin presents several reasons why we should go to the Moon and go to Mars. One reason is economic, another is to increase our scientific knowledge, and yet another is to further the political evolution of humankind through the international cooperation required for building settlements on the Moon and Mars. He concludes by expanding upon the idea that this nation has never been one to shrink from a challenge. R.J.F.

N92-33457# European Space Agency, Paris (France).
TELESCIENCE FOR SPACE EXPERIMENTATION IN THE FIELDS OF SPACE SCIENCE, LIFE, MATERIALS AND FLUID SCIENCES, AND EARTH AND ENVIRONMENTAL SCIENCES [LA TELESCIENCE AU SERVICE DE L'EXPERIMENTATION SPATIALE]
T.-Duc Guyenne, ed. Mar. 1992 124 p In ENGLISH and FRENCH Colloquium held in Paris, France, 19-20 Nov. 1991; sponsored by Association Aeronautique et Astronautique de France
(ESA-SP-331; ISBN-92-9092-166-8; ETN-92-91971) Copyright Avail: CASI HC A06/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Papers presented at the conference concerning telescience for space experimentation, and which particularly reference manned space flight and the Columbus space program, are presented. Telescience is seen as a collection of techniques which give the scientist the best adapted tool for carrying out and supporting experiments. For relatively long missions, the aim is to have the capability of reprogramming the experiment, taking into account the interpretation of the data received. Continuous dialogue is therefore required between the ground and space sections, whether directly or by the instrumentality of a machine. Three sessions are presented in the use of telescience in several fields, highlighting the fact that microgravity experiments should be even more interactive than for space science. Summaries on each session are provided. For individual titles, see N92-33458 through N92-33474.

N92-33458# Centre National d'Etudes Spatiales, Toulouse (France).
TELESCIENCE [LA TELESCIENCE] **c19**
Jacques Breton *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 9-10 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The keynote speech on telescience is presented. The use of sensors such as telescopes, microscopes, magnetometers, and changes to their operating conditions after certain observations is seen as the relationship between the scientist and the scientific goal. The characteristics of transparency and interactivity within this relationship are underlined. The maximum use of telescience in manned spaceflight and particularly within the framework of Columbus is stressed. An outline of the following three conference sessions is given: the necessity for microgravity experiments to be even more interactive than for space science experiments; the possibility of envisaging the telescience technology enabling the scientist and his research objective to be closely connected, even if the one on the ground and the other in orbit are at opposite ends of a complex system, and if each action at either end should be examined for its possible effect on the system as a whole. ESA

N92-33459# Imperial Coll. of Science and Technology, London (England).
THE TELESCIENCE CONCEPT AND ITS APPLICATION TO MANNED AND UNMANNED SPACE MISSIONS **c63**
A. Balogh *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 11-19 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The development of the telescience concept in the context of ESA's Columbus progam is set out through a close examination of the concept and its characteristic features. The telescience concept has proven useful when considering the requirements for effective user operations in the context of large, long duration space emissions. Its importance is widely recognized and techniques are being developed for its widespread use, in particular for microgravity investigations in manned or unmanned space based laboratories. The complexity of these scientific disciplines makes significant demands on the operation of payloads and it is important to examine how best to implement the right level of scientific interactivity between ground based scientists and their investigations in space. On the other hand, telescience techniques have been used, at least implicitly, in unmanned space science missions. A detailed look at a simple experiment can provide insight into the telescience concept which can be applied in more complex cases. Telescience essentially implies a control loop between ground and space, and therefore well established concepts from control system theory can be used as tools in the implementation of telescience techniques for space research. ESA

N92-33460# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
ROLE OF THE TELESCIENCES IN THE STUDY OF NATURAL PLASMAS IN THE SOLAR SYSTEM **c75**
A. Roux *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 21-26 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

An explanation of how the global images collected by the wide angle camera of AURIO (Auroral Imaging Observatory) will be processed onboard, which will allow the most active region in the auroral arcs pattern to be partially resolved, is given. The Cluster project, currently in phase B at ESA, proposes a new concept of investigating the three dimensional structures that develop as a consequence of the interaction between the solar wind and the Earth's magnetosphere. Finite differences between measurements made at the four Cluster spacecraft locations and interspacecraft correlations will be used to estimate the gradients, divergences and curls of the physical parameters, so as to characterize the turbulence. The change in the distance between the spacecraft to optimize these measurements is explained. The onboard data processing performed by the versatile digital wave processor is described and the use of the corresponding results onboard to select events and to use the best suited mode is shown. ESA

N92-33461# European Space Agency, Paris (France).
MICROGRAVITY RESEARCH: OUTLOOK AND PLANS **c29**
G. Seibert *In its* Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 27-32 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The future plans in the various microgravity disciplines of materials, fluid, and life sciences, are outlined. The status of preparation and future planning of the microgravity multiuser facilities for the Columbus Attached Laboratory are described and some remarks regarding the different operation modes of Spacelab and Columbus Space Station are made. ESA

N92-33462# Naples Univ. (Italy). Inst. of Aerodynamics.
FLUID SCIENCE AND TELESCIENCE **c34**
Rodolfo Monti *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 37-44 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The problems of telescience for microgravity experimentation is discussed and the role of telescience in the fluid science experiments is identified. The experiences with the experiments conducted in telescience on sounding rockets are reported and the features needed to satisfy the requirements of future telescience operations are discussed. Some ESA activities that intend to promote telescience for fluid science microgravity experimentations are illustrated. ESA

N92-33463# Commissariat a l'Energie Atomique, Grenoble (France). Section d'Etudes de la Solidification et de la Cristallogenese.
MATERIALS SCIENCE AND TELESCIENCE [SCIENCE DES MATERIAUX ET TELESCIENCE] **c29**
J. P. Praizey and J. J. Favier *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 45-48 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Conditions in which the Spacelab FLSP and D1 flights were carried out are recalled and those to be pre-evaluated for the Eureca 1 and D2 missions from the telescience perspective are indicated by analyzing some of the example experiences. Flight conditions for MEPHISTO (French acronym for equipment for the study of phenomena concerning solidification on Earth and in orbit), a materials science device with a real telescience approach using in situ diagnostics embedded into it, are described. The principle of the Seebeck effect in MEPHISTO is illustrated. An attempt to define, by examples, the desirable operational conditions for Columbus is made. ESA

N92-33464# State Univ. Hospital, Ballerup (Denmark). Inst. of Aerospace Medicine.
TELESCIENCE IN HUMAN PHYSIOLOGY **c52**
Niels Foldager, Nigel Wootton (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), and F. Bonde-Petersen (European Space Agency, Cologne, Germany, F.R.) *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 49-52 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

To represent human physiology, the ESA telescience team selected a bicycle exercise test as their first experiment for telescience operation. The aim was to test if a ground based Principle Investigator (PI) could make good quality experiments on subjects located in space and to evaluate the man machine interfaces and teletools provided. The experiment was integrated in hyperbaric chambers for a 72 day 300 m diving simulation and a 30 day isolation study for the European manned space infrastructure. Varying delays and disturbances were introduced on the communication links. The exercise tests required full use of the telescience tools: command links for control of the ergometer bicycle and the camera, audio and video links, and transmission of data packages and physiological waveforms. The PI coped well with link disturbances and good quality physiological data were obtained. Telescience proved to be feasible in this kind of experiment and a promising tool for space experimentation. ESA

N92-33465# Nottingham Univ. (England). Dept. of Life Science.
BIOLOGY AND TELESCIENCE **c51**
L. G. Briarty *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 53-57 (For primary document see N92-33457 24-12)
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The telescience testbed developed by ESA was used successfully to control an experiment on plant phototropism; the effects of delays and errors in the data stream, and the value of image compression were assessed. Telescience requirements for a proposed Eureca botany facility experiment are presented, together with suggestions for improvements of data handling facilities for life science experiments. ESA

N92-33466# Vrije Univ., Brussels (Belgium).
THE USOCS, THE RESOURCES MANAGEMENT, AND THEIR LINKS WITH TELESCIENCE **c81**
M. C. Limbourg *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 59-66 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The in orbit elements of the Columbus Program are the Attached Laboratory, the Free Flying Laboratory, and the Polar Platform. The Attached Laboratory is the European part of the Space Station Freedom. The European participation in the Space Station utilization is 12.8 percent, giving to Europe the same share of the space station resources. The different types of hardware proposed for Columbus are defined as well as the partition of this hardware in national and ESA utilization programs. An example of implementation of the hardware is given. The main differences between Columbus and Spacelab hardware is the modularity and telescience capability. They are imposed by the long duration of utilization. Modularity is required for easy inflight maintenance, servicing, and repair, and telescience is required for continuous operations. The ground infrastructure for Columbus utilization is described: the role of the UHB (User Home Bases), regional USOC (User Support and Operation Centers), and FRC (Facility Responsible Centers) in the telescience operation of the experiments and MUF's (Multi-User Facilties) is outlined. A modular

MUF is described with an example of a telescience experiment. The influence of teleoperation on resource utilization is discussed. ESA

N92-33467*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TELESCIENCE FROM NASA PLANETARY SPACECRAFT
Ellis D. Miner *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 67-74 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Techniques reasonably classified as 'telescience' in NASA missions are discussed. The first interplanetary probe, Mariner 2, was launched towards Venus nearly 30 years ago. Since that time, NASA has successfully completed missions to Mercury (Mariner 10), Venus (Mariners 5 and 10, Pioneers 12 and 13, Galileo, and Magellan), Mars (Mariners 4, 6, 7, and 9, and Vikings 1 and 2), Jupiter (Pioneers 10 and 11, Voyagers 1 and 2, and the approaching Galileo), Saturn (Pioneer 11, Voyagers 1 and 2, and the planned Cassini), Uranus (Voyager 2), and Neptune (Voyager 2). Missions to asteroids (Galileo, CRAF, and Cassini), and to a comet (CRAF) are presently being prepared or underway. Procedures have to be adapted to permit the latest possible updating of the planned observational sequences, to counteract the effects of a 492 minute round trip light time, and to provide automatic fault sensing and correction. Special emphasis is placed on those used for the Voyager encounter with Neptune in Aug. 1989. ESA

N92-33468# Alcatel Espace, Toulouse (France).
DELAYS INTRODUCED BY TELECOMMUNICATIONS FOR TELESCIENCE [LES DELAIS INTRODUITS PAR LES TELECOMMUNICATIONS POUR LA TELESCIENCE] **c32**
Michel Hayard *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 79-82 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Transmission delays in the telescience loop between a scientifc operator and a distant laboratory are discussed. An illustration of the communications loop is given. Video exchange between the manned Columbus module and the scientist wanting to see experiments is described and evaluated. The total waiting time is concluded to be possibly up to 10 or 20 seconds in certain cases for a complete connection. Some delays are incompressible, such as transmission time to a geostationary satellite (about 250 ms for relay). Therefore, the delay must be lived with. Dedicated solutions must be envisaged if there is a well justified need for real time, but a minimum delay cannot be avoided. ESA

N92-33469# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
IMPLEMENTATION OF TELESCIENCE REQUIREMENTS FOR IN-ORBIT-INFRASTRUCTURE GROUND SEGMENT FOR OPERATIONS **c32**
J. Volpp and U. Christ *In its* Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 83-86 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The setup of the European In Orbit Infrastructure (IOI) ground segment is described with focus on the utilization of the Attached Pressurized Module at the Space Station Manned base. The Ground segment for Flight Operations (GFO), including the European and American part is delineated. The support given by the GFO to telescience operations from user sites will be twofold: operational and communication support. The main features of the operational support and of the communication services are outlined. A summary comparing the most relevant user requirements with the actual requirements in the GFO used for the detailed definition phase is given. ESA

N92-33470# Bertin et Cie., Aix-les-Milles (France).
INTELLIGENT SENSORS AND FIBER OPTIC SENSOR NETWORKS [CAPTEURS INTELLIGENTS ET RESEAUX DE CAPTEURS A FIBRES OPTIQUES] **c74**
Jean-Pierre Volat *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 87-91 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Current developments initially aiming at industrial needs, but which are expected to find applications in several fields, in particular interactive space experimentation, are presented. These developments correspond to two complementary axes: the development of intelligent sensors, and the development of fiber optic sensor subnetworks. The advantages expected from these techniques are reduction of cabling weight, a great aptitude for data exploitation, mastership of real time, and distributed intelligence system design giving a greater decisional autonomy and a greater flexibility to adapt to unpredictable situations. ESA

N92-33471# MATRA Marconi Space, Toulouse (France).
TELESCIENCE: PREPARING THE EXPERIMENTS
Jacques Tailhades *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 93-99 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Telescience addresses the starting concept of providing the scientist with a direct and interactive access to his in-orbit experiment. Preparing the experiments in telescience is an important activity which is going to take place in the next few years to fully assess the utilization concept of the in-orbit infrastructure and the definition of the different supports to be provided to the principle investigators. The methodology which is followed to validate and prepare the payloads according to this concept is outlined. Preparation philosophy is going to be progressively integrated into the experiment preparation cycle through the first identified step, the precursor flights program. ESA

N92-33472# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Dept. Automation et Informatique.
TELESCIENCE AND THE COLUMBUS PROGRAM [LA TELESCIENCE ET LE PROGRAMME COLUMBUS]
J. C. Degavre *In its* Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 101-106 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The telescience activities of flights which can be considered as precursors to the Columbus are outlined: Spacelab D2 and E1, Eureca 2 and 3, and also the sounding rocket experiments TEXUS (German acronym for technological experiments under weightlessness) and MAXUS (Materials Science Experiment Rocket). A preliminary ground structure and onboard equipment setup is forseen which will enable certain useful loads to be relayed directly to the experiment control system at the user end. ESA

N92-33473# Spacebel Informatique, Brussels (Belgium).
APPLICATION OF THE OBJECT PARADIGM IN PAYLOAD OPERATIONS
Patrick Assis-Arantes, Eric Bernard, Guy Leonis, Thierry Racaud, John Reynolds, and Rowena Smillie *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental

Sciences Mar. 1992 p 107-112 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The applicability of the object paradigm to the payload operations activity is shown. A project currently being undertaken for the development of a man machine interface software for ground user terminal is presented. This man machine interface is based on an object oriented environment composed of three elements: a modeling system organized around the concept of objects; a specialized language allowing payload developers and operators to test/operate their payloads; and graphical synoptics for supervising, controlling and interacting with the system. ESA

N92-33474# Centre National d'Etudes Spatiales, Toulouse (France).
CONFERENCE CONCLUSIONS [CONCLUSIONS DU COLLOQUE]
Jacques Blamont *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 121-123 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Conclusions of a conference in telescience, with particular relevance to Columbus, are presented. The following rapidly developing technologies are highlighted: components (semiconductors); software; robotics (teleoperated hands); transmission; and simulation. Full telescience is concluded to be feasible in the years 2000-2005, but the situation is marked by extreme speed in evolution. Flexibility of programs is indispensable. Difficulties covering software, mechanical, teleoperator means, the organization chain, and telemeasure are highlighted. Possible action and recommendations towards the recognition of telescience as a major activity in European space programs are discussed. ESA

N92-33495*# North Carolina State Univ., Raleigh. Mars Mission Research Center.
STATUS REPORT, JUNE 1988 - APRIL 1992
Apr. 1992 241 p Prepared in cooperation with North Carolina Agricultural and Technical State Univ., Greensboro, NC
(Grant NAGw-1331)
(NASA-CR-190612; NAS 1.26:190612) Avail: CASI HC A11/MF A03

The Mars Mission Research Center (MMRC) is one of nine University Space Engineering Research Centers established in June 1988 by NASA's Office of Aeronautics and Space Technology to broaden the nation's engineering capability to meet the critical needs fo the civilian space program. It includes North Carolina State University (NCSU) at Raleigh and on North Carolina A&T State University at Greensboro. The goal of the Center is to focus on research and educational technologies necessary for planetary exploration, especially transportation to and from our moon and Mars. The research combines mission analysis and design, hypersonic aerodynamics, structures and controls, composite materials, and fabrications. Covered here are activities of the Center from June to April 1992. The Center supports 26 graduate students, 29 undergraduates, 27 faculty and 6 staff. An additional 88 undergraduates worked on four special projects. Three facilities at A&T were renovated and a new 7,000 square foot facility was occupied at NCSU in October 1991. Five laboratories have been developed for composite processing and fabrication facility (A&T), materials testing (A&T), weaving (NCSU), braiding (NCSU), and structures (NCSU). During the past two years, the Center added a new dimension to its program - special projects which involve analysis, design, construction, and testing. The first two projects were full-scale research models of a Mars aerobrake and the HL-20 Personnel Launch System. Both projects received considerable new coverage and appeared in national publications. Additional projects include a model of a Mars Exclusion Vehicle, an Orbiter Ejector, and a Remotely Operated Vehicle. The Orbiter Ejector is scheduled to fly on Shuttle Flight STS-47 in October 1992. Special projects have increased undergraduate student participation and provided a mechanism for more interaction between the universities, NASA centers, and industries. The faculty developed 26 new courses related to the activities of the Center. They conducted four workshops on interplanetary spacecraft, lunar/Mars aerobrakes, spacecraft controls, and aerodynamic heating. The Outreach Program developed into a significant component of the Center. Faculty and students have conducted 12 tours of facilities and given 67 lectures to schools (grade k-12) and civic organizations. Author

N92-33519# Air Force Inst. of Tech., Wright-Patterson AFB, OH.
ORBITING SPACE DEBRIS: DANGERS, MEASUREMENT, AND MITIGATION M.S. Thesis
Ross T. McNutt Jan. 1992 331 p
(AD-A252515; AFIT/CI/CIA-92-014) Avail: CASI HC A15/MF A03

Space debris is a growing environmental problem. Accumulation of objects in Earth orbit threatens space systems through the possibility of collisions and runaway debris multiplication. The amount of debris in orbit is uncertain due to the lack of information on the population of debris between 1 and 10 centimeters diameter. Collisions with debris even smaller than 1 cm can be catastrophic due to the high orbital velocities involved. Research efforts are under way at NASA, Unites States Space Command and the Air Force Phillips Laboratory to detect and catalog the debris population in near-Earth space. Current international and national laws are inadequate to control the proliferation of space debris. Space debris is a serious problem with large economic, military, technical, and diplomatic components. Actions need to be taken now for the following reasons: determine the full extent of the orbital debris problem; accurately predict the future evolution of the debris population; decide the extent of the debris mitigation procedures required; implement these policies on a global basis via an international treaty. Action must be initiated now, before the the loss of critical space systems such as the Space Shuttle or the Space Station. GRA

N92-33854# Science and Technology Agency, Tokyo (Japan).
THE 14TH SPACE STATION UTILIZATION WORKSHOP IN JAPAN
21 Jan. 1992 184 p In ENGLISH and JAPANESE Workshop held in Tokyo, Japan, 21-22 Jan. 1992 Prepared in cooperation with NASDA, Tokyo, Japan and Japan Space Utilization Promotion Center, Tokyo
(JTN-92-80388) Avail: CASI HC A09/MF A02

The proceedings from the Space Station Utilization Workshop are presented. The following topics were discussed: space stations, manned spacecraft, spacecraft modules, Japanese spacecraft, JEM (Japanese Experiment Module), research facilities, crew training, scheduling, spacecraft equipment, spacecraft instruments, research projects, project management, project planning, research management, mission planning, space station utilization by universities and industries, space manufacturing, spaceborne experiments, microgravity experiment, airborne experiment, parabolic flight, Get Away Special (GAS), space station structures, spacecraft structures, life science, fluid flow, Marangoni flow, semiconductors, crystal growth, lead tin telluride, gallium arsenides, indium phosphide, Spacelab project, and international cooperation. For individual titles, see N92-33855 through N92-33866.

N92-33855# Science and Technology Agency, Tokyo (Japan). Office of Space Utilization.
BASIC LINE OF SPACE STATION UTILIZATION **c18**
Junji Yoshihara *In its* The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 13-29 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

The basic experiments that will require the use of the Japanese Experiment Module (JEM), as a component of the NASA space station, are discussed. The following topics are addressed: outlines of the space station program; schematic drawings of the space station (at the Permanently Manned Capability (PMC)) and the

JEM; JEM project promotion system; present status of the JEM project; preparation status of JEM operation and utilization; characteristics of the space station program; terms of utilization; JEM utilization plan preparation schedule; selection of experiment themes and common experiment equipment; and measures to promote JEM utilization. Author (NASDA)

N92-33856# National Space Development Agency, Tokyo (Japan). Space Station Program Dept.
JEM DEVELOPMENT STATUS AND PLAN FOR JEM CREW TRAINING **c53**
Kazuhiko Yoneyama *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 31-47 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

The outline, the operation plan, and the development schedule of JEM (Japanese Experiment Module) are described. The status of JEM crew training is also outlined. The following topics are addressed: conceptual drawings of the JEM; characteristics of JEM; structure of JEM pressurized module; equipment layout on exposed facilities; fundamental issues for space station operation; conceptual drawings of JEM operation system; major JEM development and operation schedule; description of Japanese space station crew; the process from space station crew selection to their getting aboard the station; selection criteria of JEM crew; Japanese astronaut education and training schedule; details of JEM crew training; and participation in Mission Specialist (MS) training. Author (NASDA)

N92-33857*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION FREEDOM SCIENCE UTILIZATION
Edmond M. Reeves *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 49-79 (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

The status of mission planning and project planning for scientific experiments that will utilize the Space Station Freedom are described in viewgraph format. The following topics are addressed: microgravity science and pressurized volume payloads; Office of Space Science Applications (OSSA) payload facilities including Advanced Protein Crystal Growth Facility (APCGF), Space Station Furnace Facility (SSFF), life science facilities, Biomedical Monitoring and Countermeasures Program (BMAC), Centrifuge Facility (CF), and Small Rapid Response Payloads (SRR); goals and strategies of microgravity science and life science; examples of investigation area of microgravity science and life science; announcements of opportunity and NASA research announcements; science planning structures of USA; and issues of space station utilization. Author (NASDA)

N92-33858# National Space Development Agency, Tokyo (Japan). Space Experiment Group.
PREPARATION FOR UTILIZING JEM **c18**
Tadaaki Mochida *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 81-116 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

A description of the status of the space environment utilization promotion project for the Japanese Experiment Module (JEM) is provided in viewgraph format. The following topics are addressed: development of user accommodations, support systems, experiment design, experiment equipment, and common experiment technologies for the space environment utilization promotion projects; JEM utilization schedule; JEM utilization plans; space environment utilization database operation; status of experiment support technology development; plans for microgravity experiment, using sounding rocket (TR-1A); common experiment technologies to be developed and acquired by sounding rocket experiments; construction plan and structure of space experiment laboratory as part of the Space Station Integrated Project (SSIP) Center; IML-2 (International Microgravity Laboratory-2) project; international joint studies including Multilateral Science Working Group (MSWG), Space Station Spacelab Utilization Technology Working Group (UTWG), and International Space Life Science Strategic Planning Working Group (ISLSSPWG); and JEM utilization case studies including pressurized module and exposed facility experiment equipment installation models. Author (NASDA)

N92-33859# Tokyo Univ. (Japan). Inst. of Space and Astronautical Science.
BASIC LINE OF SPACE STATION UTILIZATION IN THE UNIVERSITIES
Harutou Hirosawa *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 117-118 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A01/MF A02

Outlines of the policy and activity status of the Committee for Space Utilization Research in ISAS (Institute of Space and Astronautical Science) are presented. Objectives, research subcommittees, and research disciplines of the committee are explained. The SFU (Space Flyer Unit) experiment and science experiments utilizing rocket vehicles are described. Outline of IFSUSS (International Forum on the Scientific Use of Space Station) is also mentioned. Author (NASDA)

N92-33860# Tokyo Univ. (Japan). Space Utilization Center.
SCIENTIFIC UTILIZATION OF SPACE: ACTIVITIES AMONG UNIVERSITIES
Masamichi Yamashita *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 119-122 (For primary document see N92-33854 24-12)
Avail: CASI HC A01/MF A02

The status of the Committee for Space Utilization Research in the Institute of Space and Astronautical Science (ISAS) is outlined in viewgraph form. The following topics are addressed: an explanation of the committee and the six research sub-committees; the disciplines which are stressed by the committee; the status of the ground-based research for space station studies, space flyer units experiment program, and rocket experiment; and the International Forum on Scientific Use of Space Station (IFSUSS). Author (NASDA)

N92-33861# Japan Space Utilization Promotion Center, Tokyo.
BASIC LINE OF SPACE STATION UTILIZATION IN THE INDUSTRIAL CIRCLES
Yasuaki Hashimoto *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 123-130 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

The Japan Space Utilization Promotion Center (JSUP) obtained information about space station utilization through a questionnaire that was filled out by member corporations and participants in the activities of the center. Results are summarized for following items: (1) requests for Announcements of Opportunity (AO); (2) intentions for experiment expenditure; (3) objectives for participation in experiments; (4) areas of experiment; (5) subject samples of material processing experiments; (6) procedures to process AO in the responsible sections after receiving them; (7) premises for getting in-house budget; (8) items for which national budgetary support will be requested; (9) ownership of the experiment results; (10) selection criteria for proposals from private organizations; and (11) expectations of JSUP in terms of researcher support. Author (NASDA)

N92-33862# National Aerospace Lab., Tokyo (Japan). Space Technology Research Group.
PRELIMINARY REPORT ON FLUID EXPERIMENT BY TR-1A SOUNDING ROCKET **c34**
Hisao Azuma *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992

p 131-140 (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

Five experiments were carried out to establish a experimental technology basis for fluid dynamics in space using the TR-1A rocket vehicle launched Sep. 1991. Observation of Marangoni flow and surface tension waves on a liquid silicone oil column and observation of the liquid column breaking down are conducted in microgravity conditions less than 10(exp -4) g. Images of transient Marangoni flow, steady Marangoni flow, and their surface velocity distribution are obtained. Images of the breaking down of the liquid column are also obtained. And these agreed with the results of computerized simulation. Author (NASDA)

N92-33863# Nagoya Univ. (Japan). Dept. of Aerospace Physiology.
RESULT OF AIRCRAFT EXPERIMENTS c51
Satoru Watanabe *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 141-146 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

Airborne experiments were conducted on biological system phenomena under microgravity conditions. The effect of gravity change on the vestibular apparatus in goldfish was examined. Negative reaction to light, in microgravity conditions, was also examined. One fish had its vestibular apparatus removed and the other did not. The latter always swam with its back directed upward (0 deg) when illuminated from above, but it swam with its back directed at an angle (20 to 30 deg) when illuminated from the side (90 deg). The former laid down with its back directed toward the light. Normal goldfish took an attitude called diving response (head down) in microgravity, but diving response was not observed in the fish that had undergone removal of the vestibular apparatus. Fish which returned to normal swimming after the operation showed diving response, though they had no vestibular apparatus, making it clear that diving response is not caused by said organ.
Author (NASDA)

N92-33864# Fujitsu Ltd., Tokyo (Japan).
RESULT OF EXPERIMENTS BY GAS (GET AWAY SPECIAL): SEMICONDUCTOR CRYSTAL GROWTH EXPERIMENT IN MICROGRAVITY USING GAS PROGRAM c76
Shigeo Kodama, Kinji Nishio, Masahiro Takayanagi, Hiroshi Nemoto, Shinichi Kitamura, Yuuichi Suzuki, Osamu Ueda, Osamu Ootsuki, and Ken Kotani *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 147-159 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

Space manufacturing experiments utilizing the Get Away Special (GAS) program were conducted as pretests for future large scale space experiments. Crystal growth of PbSnTe and GaAs in microgravity using CVD (Chemical Vapor Deposition) and liquid phase epitaxy, respectively, were observed. The influence of epitaxy on the back of the substrate and the state of crystal growth on the substrate surface were observed using Scanning Electron Microscope (SEM). The surface configuration of substrates processed in space is flatter than the configuration of a substrate processed on the earth. It is also found that the surface flatness of the substrate depended on the crystal faces (Miller indices).
Author (NASDA)

N92-33865# Tokyo Univ. (Japan). Dept. of Electronic Engineering.
STATUS OF INTERNATIONAL CO-OPERATION. CASE STUDY: ELUCIDATION OF THE CAUSE AND CONTROL OF SECOND IMPURITY PATTERN IN SEMICONDUCTORS [KOKUSAI KYOURYOKU NI YORU JIKKEN SEIKA. KESU SUTADI: HANDOUTAI NI OKERU DAI 2 SHU FUJUNBUTSUJIMA NO KEISEI GENIN NO KAIMEI TO YOKUSEI] c76
Tatau Nishinaga *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 161-168 In JAPANESE Prepared in cooperation with Freiburg Univ., Fed. Republic of Germany (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

Cause and control of the 2nd impurity patterns in tellurium doped gallium antimonide and sulfur doped indium phosphide semiconductors were studied. The semiconductors were made using the Travelling Heater Method (THM) on Spacelab SL-1 (1983) and D-1 (1985). Samples were chemically etched and observed by spatial resolution photo luminescence method. As a result, the condition to control the formation of the 2nd impurity pattern is elucidated, and crystal growth without 1st or 2nd impurity patterns can be obtained using the THM method in microgravity. Methods to remove the macrosteps formed by LPE (Liquid Phase Epitaxy), which is a method for the formation of semiconductor thin solids, are found. It is made clear that the latter result is attributable to ground technology improvement yielded by analyzing experiments in microgravity. It is made clear that accurate research on the formation and disappearance of 2nd impurity patterns and accurate measurement of physical constants, such as the diffusion coefficient, are possible in microgravity conditions due to lack of thermal convection. Author (NASDA)

N92-33866*# National Aeronautics and Space Administration, Washington, DC.
THE SPACELAB LIFE SCIENCES 1 SHUTTLE MISSION c29
Robert W. Phillips *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 169-174 (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

Changes in human physiology, particularly cardiovascular and metabolic, were investigated during the Spacelab Life Science-1 (SLS-1) mission in Jun. 1991. Television tape recordings were made before, during, and after the mission. An overview of some of the research findings from the SLS-1 mission is presented. It is pointed out that some changes begin on the launch pad, and others occur following arrival in orbit. It is shown that the cardiovascular, pulmonary, fluid, and electrolyte changes in orbit are consistent with the hypothesis that they are normal adaptive responses to the new environment and are not detrimental to the individual. Much of the cardiovascular and pulmonary readaptation was completed by the end of the second day after landing.
Author (NASDA)

N92-33937*# National Aeronautics and Space Administration, Washington, DC.
ADVANCED TECHNOLOGY FOR AMERICA'S FUTURE IN SPACE
Dec. 1990 97 p Original contains color illustrations
(NASA-TM-107968; NAS 1.15:107968) Avail: CASI HC A05/MF A02; 8 functional color pages

In response to Recommendation 8 of the Augustine Committee Report, NASA's Office of Aeronautics, Exploration and Technology (OAET) developed a proposed 'Integrated Technology Plan for the Civil Space Program' that entails substantial changes in the processes, structure and the content of NASA's space research and technology program. The Space Systems and Technology Advisory Committee (SSTAC, a subcommittee of the NASA Advisory Committee) and several other senior, expert, informed advisory groups conducted a review of NASA's proposed Integrated Technology Plan (ITP). This review was in response to the specific request in Recommendation 8 that 'NASA utilize an expert, outside review process, managed from headquarters, to assist in the allocation of technology funds'. This document, the final report from that review, addresses: (1) summary recommendations; (2) mission needs; (3) the integrated technology plan; (4) summary reports of the technical panels; and (5) conclusions and observations. Author

N92-34059 Robertson (Donald F.), San Francisco, CA.
CHEAP SPACEFLIGHT PROMISED AGAIN: IS SINGLE-STAGE-TO-ORBIT FINALLY THE ANSWER?
Donald F. Robertson 1992 21 p
Copyright Avail: Issuing Activity

Chemical rocket fuel is cheap, and rockets, in theory, are simple devices, but spaceflight remains one of Western civilization's most expensive activities. The problems are that it takes close to the maximum power that a chemical rocket can achieve just to lift a fuel tank, rocket engines, vehicle structure, and the diminishing quantity of fuel all the way to orbit. The solution to that problem causes the second. By staging a rocket, its performance is improved, but it vastly increases the complexity of the rocket. Three potential solutions are: (1) to improve the performance of the rocket engines, but performance equals cost and today's most efficient engines already yield fairly close to the best performance that chemical rockets can produce; (2) to reduce the weight and volume of the fuel that must be carried in the tank, which is the approach of the National Aerospace Plane project; and (3) to reduce the weight and complexity of the vehicle as a system, which is perhaps the most promising approach. Technical advances may allow what has been considered largely impractical: a chemical Earth-to-orbit rocket without stages, a Single-Stage-To-Orbit vehicle (SSTO) or Delta Clipper. The detailed program is addressed. I.I.C.

N92-34245*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE SPACEGUARD SURVEY: REPORT OF THE NASA INTERNATIONAL NEAR-EARTH-OBJECT DETECTION WORKSHOP
David Morrison, ed. 25 Jan. 1992 64 p
(NASA-TM-107979; NAS 1.15:107979) Avail: CASI HC A04/MF A01

Impacts by Earth-approaching asteroids and comets pose a significant hazard to life and property. Although the annual probability of the Earth being struck by a large asteroid or comet is extremely small, the consequences of such a collision are so catastrophic that it is prudent to assess the nature of the threat and to prepare to deal with it. The first step in any program for the prevention or mitigation of impact catastrophes must involve a comprehensive search for Earth-crossing asteroids and comets and a detailed analysis of their orbits. At the request of the U.S. Congress, NASA has carried out a preliminary study to define a program for dramatically increasing the detection rate of Earth-crossing objects, as documented in this workshop report. Author

N92-33759# National Space Development Agency, Tokyo (Japan). Program Planning and Management Dept.
FUTURE SPACE ACTIVITIES CONDUCTED BY THE NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN [NASDA NO SHOURAI NO UCHUU KATSUDOU]
Youji Shibatou *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 10 p In JAPANESE
(For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

N92-33760# National Space Development Agency, Ibaraki (Japan).
UNMANNED MARS EXPLORATION MISSION [MUJIN KASEI TANSA MISSHON]
Toshihide Maeda *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 24 p In JAPANESE
(For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N92-33841 Mississippi State Univ., State College.
PREDICTION OF LOW ECCENTRICITY SATELLITE ORBITS CONSIDERING EARTH OBLATENESS AND ATMOSPHERIC DRAG Ph.D. Thesis
Steven Wendell Evans 1991 194 p
Avail: Univ. Microfilms Order No. DA9131233

The problem of analytic ephemeris prediction for satellites moving in low altitude, nearly circular orbits, and experiencing atmospheric drag is addressed. The method of two-variable asymptotic expansion used previously for the case of larger eccentricity orbits was extended to the low eccentricity case. A computer program to implement the analytic solutions was written and tested against existing analytical and numerical simulation programs currently used by NASA's Marshall Space Flight Center. These tests indicate that this analytical method is a feasible solution to this problem. The refinement of the current program to the status of a reliable mission planning tool should be a straightforward procedure. Dissert. Abstr.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N92-33303# Naval Postgraduate School, Monterey, CA.
THE DEVELOPMENT OF AN INFORMATION SYSTEM MASTER PLAN FOR THE PACIFIC MISSILE RANGE FACILITY, BARKING SANDS, HAWAII M.S. Thesis
Rolando A. Apollo and Paul D. Bennett Mar. 1992 77 p
(AD-A252970) Avail: CASI HC A05/MF A01

This thesis provides a general description of the communication facilities and systems currently used by the Pacific Missile Range Facility (PMRF). The system interface requirements to support current range operations are identified and a description of current communications system shortfalls is provided along with recommendations for short-term improvements. A vision of the future is also provided. It suggests that PMRF adopt a coordinated, integrated, and centralized approach to range communications. Current and future communications system technologies such as digital communications, applicability of different transmission media, and application of the Integrated Services Digital Network (ISDN) are mentioned as avenues for implementing a fully integrated data, voice, and video real-time information network that will support future PMRF users' requirements. GRA

N92-34114*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
LOW POWER ARCJET TEST FACILITY IMPACTS
W. Earl Morren and Paul J. Lichon (Rocket Research Corp., Redmond, WA.) Sep. 1992 22 p Presented at the 28th Joint Propulsion Conference and Exhibit, Nashville, TN, 6-8 Jul. 1992; sponsored by AIAA, SAE, ASME, and ASEE
(RTOP 506-42-31)
(NASA-TM-105876; E-7341; NAS 1.15:105876; AIAA Paper 92-3532) Copyright Avail: CASI HC A03/MF A01

Performance characterization of a flight-type 1.4 kW arcjet system were conducted at the Rocket Research Company (RRC) in Redmond, WA, and at the NASA LeRC in Cleveland, OH. The objectives of these tests were as follows: to compare low-power arcjet performance at two different test facilities; to compare arcjet performance obtained with a 2:1 mixture of gaseous hydrogen and nitrogen and hydrazine; and to quantify the effects of test cell pressure on thruster operating characteristics. Performance and thruster temperature distributions were measured at thruster input power levels and propellant mass flow rates ranging from 1274 to 1370 W and from 3.2 x 10(exp -5) to 5.1 x 10(exp -5) kg/s, respectively. Specific impulses measured at the two facilities, at comparable test cell pressures, using gaseous hydrogen-nitrogen propellant mixtures agreed to within 1 percent over the range of operating conditions tested. The specific impulses measured using hydrazine propellant were higher than that for the cold hydrogen-nitrogen mixtures. Agreement between by hydrazine and

gas mixture data was good, however, when the differences in propellant enthalpies at the thruster inlet were considered. Specific impulse showed a strong dependence on test facility pressure, and was 3 to 4 percent higher below 0.1 Pa than for test cell pressures above 5 Pa. Author

N92-34123# Range Commanders Council, White Sands Missile Range, NM. Electronic Trajectory Measurements Group.
TRANSPONDER ASSETS
Jul. 1992 13 p
(AD-A253163; ETMG-258-92) Avail: CASI HC A03/MF A01

This document provides the reader with a list of transponder assets and points of contact at RCC affiliated ranges and facilities. A range would be able to locate the needed transponder in an emergency situation and make arrangements for a loan. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N92-34080*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
LIFESAT ENGINEERING IN-HOUSE VEHICLE DESIGN
A. Adkins, G. Badhwar, L. Bryant, J. Caram, G. Conley, T. Crull, P. Cuthbert, E. Darcy, P. DeLaune, and M. Edeen et al Jul. 1992 213 p Prepared in cooperation with Lockheed Corp., Houston, TX; McDonnell-Douglas Corp., Houston, TX; and Computer Sciences Corp., Houston, TX
(NASA-TM-104752; S-685; NAS 1.15:104752) Avail: CASI HC A10/MF A03

The LifeSat program was initiated to research the effects of microgravity and cosmic radiation on living organisms. The effects of long-term human exposure to free-space radiation fields over a range of gravitational environments has long been recognized as one of the primary design uncertainties for human space exploration. A critical design issue in the radiation biology requirements was the lack of definition of the minimum radiation absorbed dosage required to produce statistically meaningful data. The Phase A study produced a spacecraft conceptual design resembling a Discoverer configuration with a total weight of approximately 2800 pounds that would carry a 525-pound payload module (45 inches in diameter and 36 inches long) and support up to 12 rodents and a general biology module supporting lower life forms for an on-orbit duration of up to 60 days. The phase B conceptual designs focused on gravitational biology requirements and only briefly addressed the design impacts of the shift toward radiobiological science that occurred during the latter half of the Phase B studies. Author

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N92-33708*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
DEBRIS/ICE/TPS ASSESSMENT AND INTEGRATED PHOTOGRAPHIC ANALYSIS FOR SHUTTLE MISSION STS-50
Scott A. Higginbotham, J. Bradley Davis, and Gregory N. Katnik Aug. 1992 148 p LIMITED REPRODUCIBILITY: More than 20% of this document may be affected by color photographs Original contains color illustrations
(NASA-TM-107550; NAS 1.15:107550) Avail: CASI HC A07/MF A02; 73 functional color pages

Thermal Protection System (TPS) assessment and integrated photographic analysis was conducted for Shuttle Mission STS-50. Debris inspections of the flight elements and launch pad were performed before and after launch. Ice/frost conditions on the external tank were assessed by the use of computer programs, nomographs, and infrared scanner data during cryogenic loading of the vehicle followed by on-pad visual inspection. High speed photography was analyzed after launch to identify ice/debris sources and evaluate potential vehicle damage and/or in-flight anomalies. The debris/ice/TPS conditions and integrated photographic analysis of Shuttle Mission STS-50, and the resulting effect on the Space Shuttle Program are documented. Author

N92-33734*# Martin Marietta Corp., Denver, CO.
INTERPLANETARY PROGRAM TO OPTIMIZE SPACE TRAJECTORIES (IPOST). VOLUME 2: ANALYTIC MANUAL Final Report
P. E. Hong, P. D. Kent, D. W. Olson, and C. A. Vallado 31 Jul. 1992 67 p
(Contract NAS1-18147; RTOP 506-49-11-02)
(NASA-CR-189653-Vol-2; NAS 1.26:189653-Vol-2) Avail: CASI HC A04/MF A01

The Interplanetary Program to Optimize Space Trajectories (IPOST) is intended to support many analysis phases, from early interplanetary feasibility studies through spacecraft development and operations. The IPOST output provides information for sizing and understanding mission impacts related to propulsion, guidance, communications, sensor/actuators, payload, and other dynamic and geometric environments. IPOST models three degree of freedom trajectory events, such as launch/ascent, orbital coast, propulsive maneuvering (impulsive and finite burn), gravity assist, and atmospheric entry. Trajectory propagation is performed using a choice of Cowell, Encke, multiconic, onestep, or conic methods. The user identifies a desired sequence of trajectory events, and selects which parameters are independent (controls) and dependent (targets), as well as other constraints and the cost function. Targeting and optimization is performed using the Stanford NPSOL algorithm. IPOST structure allows subproblems within a master optimization problem to aid in the general constrained parameter optimization solution. An alternate optimization method uses implicit simulation and collocation techniques. Author

N92-34244*# Rockwell International Corp., Downey, CA. Space Systems Div.
ADVANCED MANNED LAUNCH SYSTEM (AMLS) STUDY Final Report
Carl F. Ehrlich, Jr., Jack Potts, Jerry Brown, Ken Schell, Mary Manley, Irving Chen, Richard Earhart, Chuck Urrutia, Ray Randolph, and Jim Morris et al 30 Sep. 1992 230 p
(Contract NAS1-18975; RTOP 906-11-01)
(NASA-CR-189673; NAS 1.26:189673; SSD-90-D0674) Avail: CASI HC A11/MF A03

To assure national leadership in space operations and exploration in the future, NASA must be able to provide cost effective and operationally efficient space transportation. Several NASA studies and the joint NASA/DoD Space Transportation Architecture Studies (STAS) have shown the need for a multi-vehicle space transportation system with designs driven by enhanced operations and low costs. NASA is currently studying an advanced manned launch system (AMLS) approach to transport crew and cargo to the Space Station Freedom. Several single and multiple stage systems from air-breathing to all-rocket concepts are being examined in a series of studies potential replacements for the Space Shuttle launch system in the 2000-2010 time frame. Rockwell International Corporation, under contract to the NASA Langley Research Center, has analyzed a two-stage all-rocket concept to determine whether this class of vehicles is appropriate for the AMLS function. The results of the pre-phase A study are discussed. Author

N92-33317*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SPACE TRANSPORTATION
Ron Kahl *In its* Third SEI Technical Interchange: Proceedings 1992 p 116-138 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33342*# Martin Marietta Corp., Denver, CO.
MULTI STAGE LUNAR LANDER STORABLE VERSUS CRYO PROPULSION
John R. Hodge *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 507-521 (For primary document see N92-33309 24-12)
(Contract NAS8-37856)
Avail: CASI HC A03/MF A05

N92-33787# National Space Development Agency, Tokyo (Japan). System Engineering Dept.
FUTURE TRANSPORTATION SYSTEMS [SHOURAI GATA YUSOU KEI NI TSUITE]
Takao Etou *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 12 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33788# Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON ORBIT TRANSFER VEHICLES TO BE LAUNCHED BY H-2 LAUNCH VEHICLES [H-2 ROKETTO TOUSAI GATA KIDOU KAN YUSOU KI NO KENTOU]
Takahiro Itou *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33789# Hitachi Ltd., Tokyo (Japan).
CONCEPTUAL STUDY ON ORBIT TRANSFER VEHICLE LAUNCHED BY H-2 LAUNCH VEHICLES [H-2 ROKETTO YOU KIDOU KAN YUSOU KI NO GAINEN SEKKEI]
Kouhei Katou, Masaya Yamamoto, Takeshi Kawazoe, Kazuhisa Kaneko, and Toshiyuki Tanaka *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33792# Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON TRANSPORTATION SYSTEMS FOR MANNED LUNAR MISSIONS [YUUJIN TSUKI MISSHON NI KANSURU YUSOU SHISUTEMU NO KENTOU]
Takahiro Itou *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 14 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N92-33583 DX Antenna Co. Ltd. (Japan).
DEVICE AND METHOD FOR AUTOMATICALLY TRACKING SATELLITE BY RECEIVING ANTENNA Patent
Sumitaka Ueshin, inventor (to CISTI) 4 Apr. 1989 19 p
(CA-Patent-1-252-194; Int-Patent-Class-H01Q-3/02; Int-Patent-Class-H01Q-3/16; Int-Patent-Class-H01Q-3/18; CTN-91-60142) Avail: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

A method and a device for tracking a communication satellite using a parabolic antenna carried on a moving body are described. The method can significantly improve tracking accuracy. The antenna is first caused to scan the whole azimuth about a starting reference elevation until the received signal exceeds a first reference level. Thereafter, the antenna is driven so that its axis drafts a rectangular spiral on the celestial sphere until the received signal exceeds a second reference level. This scan search is repeated as a correction search when the received signal drops below the second reference level due to movement of the moving body. The system has a primary radiator located at the focus of the parabolic reflector and an auxiliary primary radiator located close to the main radiator so as to have a slight azimuthal deviation from the main radiator. The main and auxiliary level detectors are coupled to the main and auxiliary radiators. The primary control responds to the main signal level. The second control means is responsive to the difference between the main and auxiliary signal levels so that the difference maintains a predetermined polarity. The third control initiates corrective action when the main signal drops below a predetermined level. The three control means are included in a single microcomputer. CISTI

N92-33933*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE EFFECTS OF VIDEO COMPRESSION ON ACCEPTABILITY OF IMAGES FOR MONITORING LIFE SCIENCES EXPERIMENTS
Richard F. Haines (Foothill-De Anza Community Coll., Los Altos Hills, CA.) and Sherry L. Chuang Jul. 1992 18 p Presented at the IEEE Computer Society Data Compression Conference, Snowbird, UT, 24-26 Mar. 1992
(RTOP 476-14-03)
(NASA-TP-3239; A-92040; NAS 1.60:3239) Avail: CASI HC A03/MF A01

Future manned space operations for Space Station Freedom will call for a variety of carefully planned multimedia digital communications, including full-frame-rate color video, to support remote operations of scientific experiments. This paper presents the results of an investigation to determine if video compression is a viable solution to transmission bandwidth constraints. It reports on the impact of different levels of compression and associated calculational parameters on image acceptability to investigators in life-sciences research at ARC. Three nonhuman life-sciences disciplines (plant, rodent, and primate biology) were selected for this study. A total of 33 subjects viewed experimental scenes in their own scientific disciplines. Ten plant scientists viewed still images of wheat stalks at various stages of growth. Each image was compressed to four different compression levels using the Joint Photographic Expert Group (JPEG) standard algorithm, and the images were presented in random order. Twelve and eleven staffmembers viewed 30-sec videotaped segments showing small rodents and a small primate, respectively. Each segment was repeated at four different compression levels in random order using an inverse cosine transform (ICT) algorithm. Each viewer made a series of subjective image-quality ratings. There was a significant difference in image ratings according to the type of scene viewed within disciplines; thus, ratings were scene dependent. Image (still and motion) acceptability does, in fact, vary according to compression level. The JPEG still-image-compression levels, even with the large range of 5:1 to 120:1 in this study, yielded equally high levels of acceptability. In contrast, the ICT algorithm for motion compression yielded a sharp decline in acceptability below 768 kb/sec. Therefore, if video compression is to be used as a solution for overcoming transmission bandwidth constraints, the effective management of the ratio and compression parameters according to scientific discipline and experiment type is critical to the success of remote experiments. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N92-33400# General Accounting Office, Washington, DC.
SPACE STATION: IMPROVING NASA'S PLANNING FOR EXTERNAL MAINTENANCE. REPORT TO THE CHAIR, GOVERNMENT ACTIVITIES AND TRANSPORTATION SUBCOMMITTEE, COMMITTEE ON GOVERNMENT OPERATIONS, AND HOUSE OF REPRESENTATIVES
Jul. 1992 37 p
(GAO/NSIAD-92-271; B-249408) Avail: CASI HC A03/MF A01; GAO, PO Box 6015, Gaithersburg, MD 20877 HC

In 1996, NASA plans to begin assembly of the international Space Station Freedom in low earth orbit. One of the greatest challenges facing NASA will be maintaining the Space Station's external components throughout the assembly period and over its anticipated 30-year life using astronauts to perform extravehicular activity (EVA). The amount of EVA that can be performed is limited, and the activity is inherently risky, given the harsh environment of space. The United States General Accounting Office (GAO) review of NASA's efforts to determine the Space Station's EVA maintenance requirements and its plans to meet those requirements is presented. K.S.

N92-33486*# TRW, Inc., Huntsville, AL. System Development Div.
SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY FOR NASA/MSFC. CONCEPT DOCUMENT Study Report, Jan. - Dec. 1990
Dec. 1990 104 p Prepared in cooperation with Essex Corp., Huntsville, AL and Grumman Data Systems Corp., Woodbury, NY
(Contract NAS8-37745)
(NASA-CR-184372; NAS 1.26:184372; MSFC-SPEC-1764-V-1.4) Avail: CASI HC A06/MF A02

NASA's Space Station Freedom Program (SSFP) planning efforts have identified a need for a payload training simulator system to serve as both a training facility and as a demonstrator to validate operational concepts. The envisioned MSFC Payload Training Complex (PTC) required to meet this need will train the Space Station Payload of experiments that will be onboard the Space Station Freedom. The simulation will support the Payload Training Complex at MSFC. The purpose of this SCS Study is to investigate issues related to the SCS, alternative requirements, simulator approaches, and state-of-the-art technologies to develop candidate concepts and designs. Author

N92-33545# Panametrics, Inc., Waltham, MA.
DEVELOP AND FABRICATE A RADIATION DOSE MEASUREMENT SYSTEM FOR SATELLITES
Paul R. Morel, Frederick Hanser, Bronislaw K. Dichter, Jeff Belue, and Ram Cohen Jan. 1992 33 p
(Contract F19628-90-C-0147)
(AD-A252839; PL-TR-92-2020; AD-E201068; SR-1) Avail: CASI HC A03/MF A01

A second generation dosimeter is being designed to fulfill the need for accurate radiation dose measurements. Two identical dosimeters, a flight unit and a backup unit, are to be fabricated, tested and calibrated. The flight dosimeter is to be integrated into the payload of the Advanced Photovoltaic Electronic Experiment (APEX) satellite, as part of the Photovoltaic Array Space Power Plus Diagnostics (PASP Plus) experiment. GRA

N92-33669*# TRW, Inc., Huntsville, AL. System Development Div.
SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY FOR NASA/MSFC. PHASED DEVELOPMENT PLAN Study Report, Jan. - Dec. 1990
7 Dec. 1990 23 p Prepared in cooperation with Essex Corp., Huntsville, AL and Grumman Data Systems Corp., Woodbury, NY
(Contract NAS8-37745)
(NASA-CR-184370; NAS 1.26:184370; TRW-SCS-90-XT3) Avail: CASI HC A03/MF A01

NASA's Space Station Freedom Program (SSFP) planning efforts have identified a need for a payload training simulator system to serve as both a training facility and as a demonstrator to validate operational concepts. The envisioned MSFC Payload Training Complex (PTC) required to meet this need will train the Space Station payload scientists, station scientists and ground controllers to operate the wide variety of experiments that will be onboard the Space Station Freedom. The Simulation Computer System (SCS) is made up of computer hardware, software, and workstations that will support the Payload Training Complex at MSFC. The purpose of this SCS Study is to investigate issues related to the SCS, alternative requirements, simulator approaches, and state-of-the-art technologies to develop candidate concepts and designs. Author

N92-33718*# Sverdrup Technology, Inc., Huntsville, AL.
BALLISTIC LIMIT REGRESSION ANALYSIS FOR SPACE STATION FREEDOM METEOROID AND SPACE DEBRIS PROTECTION SYSTEM Final Report
William H. Jolly May 1992 120 p
(Contract NAS8-37814)
(NASA-CR-184374; NAS 1.26:184374; Rept-661-001-92-008)
Avail: CASI HC A06/MF A02

Relationships defining the ballistic limit of Space Station Freedom's (SSF) dual wall protection systems have been determined. These functions were regressed from empirical data found in Marshall Space Flight Center's (MSFC) Hypervelocity Impact Testing Summary (HITS) for the velocity range between three and seven kilometers per second. A stepwise linear least squares regression was used to determine the coefficients of several expressions that define a ballistic limit surface. Using statistical significance indicators and graphical comparisons to other limit curves, a final set of expressions is recommended for potential use in Probability of No Critical Flaw (PNCF) calculations for Space Station. The three equations listed below represent the mean curves for normal, 45 degree, and 65 degree obliquity ballistic limits, respectively, for a dual wall protection system consisting of a thin 6061-T6 aluminum bumper spaced 4.0 inches from a .125 inches thick 2219-T87 rear wall with multiple layer thermal insulation installed between the two walls. Normal obliquity is d(sub c) = 1.0514 v(exp 0.2983 t(sub 1)(exp 0.5228). Forty-five degree obliquity is d(sub c) = 0.8591 v(exp 0.0428) t(sub 1)(exp 0.2063). Sixty-five degree obliquity is d(sub c) = 0.2824 v(exp 0.1986) t(sub 1)(exp -0.3874). Plots of these curves are provided. A sensitivity study on the effects of using these new equations in the probability of no critical flaw analysis indicated a negligible increase in the performance of the dual wall protection system for SSF over the current baseline. The magnitude of the increase was 0.17 percent over 25 years on the MB-7 configuration run with the Bumper II program code. Author

N92-33739*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE FIRST MISSION OF THE TETHERED SATELLITE SYSTEM
C. Blake Powers, ed. (Essex Corp., Huntsville, AL.), Charlotte Shea (Essex Corp., Huntsville, AL.), and Tracy McMahan (Essex Corp., Huntsville, AL.) 1992 41 p LIMITED REPRODUCIBILITY: More than 20 percent of this document may be affected by color photographs original contains color illustrations
(NASA-TM-107955; NAS 1.15:107955) Avail: CASI HC A03/MF A01; 26 functional color pages

The era of space-age tethered operations moves toward reality with the launch of Tethered Satellite System-1 (TSS-1). The primary

objective of this mission is to demonstrate the technology of long tethered systems in space and to demonstrate, through scientific investigations, that such systems are useful for research. Author

N92-33833*# L Systems, Inc., El Segundo, CA.
RISK ANALYSIS OF SPACE TRANSPORTATION DURING THE SPACE STATION ERA Final Report
15 Dec. 1989 102 p
(Contract NAS8-38076)
(NASA-CR-184366; NAS 1.26:184366; LSYS-89-216) Avail: CASI HC A06/MF A02

This study addresses the operational risks of manned space transportation during the era of space station deployment along with alternative launch vehicle architectures to reduce the risks. Vehicle architectures considered included shuttle only, an additional unmanned launch vehicle, and a second manned/unmanned launch vehicle. Projections are made for the operational parameters and flight event probabilities. Using these projections and Space Station era mission models, the operability of alternative vehicle architectures are examined, and implications to future manned space program plans are summarized. Author

N92-33954 Colorado Univ., Boulder.
ASSEMBLY INTERRUPTABILITY ROBUSTNESS MODEL WITH APPLICATIONS TO SPACE STATION FREEDOM Ph.D. Thesis
James William Wade 1991 347 p
Avail: Univ. Microfilms Order No. DA9206636

Interruptability robustness of a construction project together with its assembly sequence may be measured by calculating the probability of its survival and successful completion in the face of unplanned interruptions of the assembly process. Such an interruption may jeopardize the survival of the structure being assembled, the survival of the support equipment, and/or the safety of the members of the construction crew, depending upon the stage in the assembly sequence when the interruption occurs. The interruption may be due to a number of actors such as: machinery break-downs, environmental damage, worker emergency illness or injury, etc. Each source of interruption has a probability of occurring, and adds an associated probability of loss, schedule delay, and cost to the project. Several options may exist for reducing the consequences of an interruption at a given point in the assembly sequence, including altering the assembly sequence, adding extra components or equipment as interruptability 'insurance', increasing the capability of support facilities, etc. Each option may provide a different overall performance of the project as it relates to success, assembly time, and project cost. The Interruptability Robustness Model was devised and provides a method which allows the overall interruptability robustness of construction of a project design and its assembly sequence to be quantified. In addition, it identifies the susceptibility to interruptions for the assembly sequence at all points within the assembly sequence. The model is applied to the present problem of quantifying and improving interruptability robustness during the construction of Space Station Freedom. This application was used as a touchstone for devising the Interruptability Robustness Model. However, the model may be utilized to assist in the analysis of interruptability robustness for other space-related construction projects such as the lunar base and orbital assembly of the manned Mars spacecraft, as well as complex terrestrial construction projects such as undersea laboratories, Antarctic bases, skyscrapers, etc. Dissert. Abstr.

N92-33960 Old Dominion Univ., Norfolk, VA.
INTEGRATED SYSTEM IDENTIFICATION AND ADAPTIVE STATE ESTIMATION FOR CONTROL OF FLEXIBLE SPACE STRUCTURES Ph.D. Thesis
Chung-Wen Chen 1991 199 p
Avail: Univ. Microfilms Order No. DA9130673

Accurate state information is crucial for control of flexible space structures in which the state feedback strategy is used. The performance of a state estimator relies on accurate knowledge about both the system and its disturbances, which are represented by system model and noise covariances respectively. For flexible space structures, due to their great flexibility, obtaining good models from ground testing is not possible. In addition, the characteristics of the system in operation may vary due to temperature gradient, reorientation, and deterioration of material, etc. Moreover, the disturbances during operation are usually not known. Therefore, adaptive methods of system identification and state estimation are desirable for control of flexible space structures. This dissertation solves the state estimation problem under three situations: having system model and noise covariances, having system model but no noise covariances, and having neither system model nor noise covariances. Recursive least-squares techniques, which require no initial knowledge of the system and noises, are used to identify a matrix polynomial model of the system, then a state Kalman filter gain is calculated from the coefficients of the identified matrix polynomial model. The derived methods are suitable for on-board adaptive applications. An experimental example is included to validate the derivations. Dissert. Abstr.

N92-33963# Sandia National Labs., Albuquerque, NM.
PRINCIPAL AXIS MISALIGNMENT CONTROL FOR DECONING OF SPINNING SPACECRAFT
J. E. White and R. D. Robinett, III 1992 48 p Presented at the American Institute of Aeronautics and Astronautics (AIAA) Meeting, Hilton Head, SC, 10-12 Aug. 1992
(Contract DE-AC04-76DP-00789)
(DE92-006802; SAND-91-2823C; CONF-920845-1-Draft) Avail: CASI HC A03/MF A01

Deconing controllers are developed for a spinning spacecraft, where the control mechanism is that of axial or radial moving masses that are used to produce intentional, transient principal axis misalignments. A single mass axial controller is used to motivate the concept, and then axial and radial dual mass controllers are described. The two mass problem is of particular interest since spacecraft imbalances can be simultaneously removed with the same control logic. Each controller is tested via simulation for its ability to eliminate existing coning motion for a range of spin rates. Both controllers are developed via a linear-quadratic-regulator synthesis procedure, which is motivated by their multi-input/multi-output nature. The dynamic coupling in the radial two mass control problem introduces some particularly interesting design complications. DOE

N92-33971 Texas A&M Univ., College Station.
TIME-OPTIMAL SPACECRAFT REORIENTATION: A QUASI CLOSED-FORM CONTROL LAW Ph.D. Thesis
Robert Michael Byers 1991 110 p
Avail: Univ. Microfilms Order No. DA9133917

The problem of slewing a spacecraft from an arbitrary initial orientation to a desired target state in minimum time is addressed. The nature of the time optimal trajectories is observed via an open loop solution using the Switch Time Optimization algorithm developed by Meier and Bryson. Conclusions as to the number and timing of control switches are drawn and substantiated analytically. The solution of the kinematic differential equations for Euler (Quaternion) Parameters is examined for systems in which the applied torque is much greater than the nonlinear gyroscopic terms in Euler's equations. An approximate solution to these equations is used to construct the state transition matrix for a desired maneuver. This allows the solution of the required switch times for an assumed control sequence. The rapid solution of all admissible sequences permits the selection of the minimum time solution in near-real-time. Given the approximate switch times, uncoupled switching functions are generated for feedback control. The resulting feedforward/feedback control law is simulated using a model of the Advanced Structure Technology Research Experiment (ASTREX) test article at the USAF Astronautics Laboratory. Finally, the robustness of the feedback control in the presence inertia matrix uncertainty is considered. Dissert. Abstr.

N92-33972 Colorado Univ., Boulder.
A TOTAL-LAGRANGIAN BEAM ELEMENT FOR ANALYSIS OF NON-LINEAR SPACE STRUCTURES Ph.D. Thesis

Luis Angel Crivelli 1991 210 p
Avail: Univ. Microfilms Order No. DA9132559

A total-Lagrangian formulation for the large-displacement large-rotation static analysis of beams is presented. The Timoshenko beam theory, in which cross-section rotations are independent of the motion of the neutral axis, is used. The beam motion is referred to an inertial reference frame and it is split into a translational component--the motion of the neutral axis--and a cross-section rotational component. Specialized forms of the Green-Lagrange strain and the second Piola-Kirchhoff stress are obtained. The formulation uses a large deformation measure, and it accounts for bending-stretching and bending-torsional coupling effects without introducing special provisions. A kinematically-independent formulation is obtained which allows developing the core components of the finite element matrices independently of the parametrization chosen for the large rotations. The corresponding representation of these core matrices in terms of a given parametrization is obtained through simple matrix transformations. Results are presented for the rotational vector representation. A physical interpretation of the matrix equations is also given, which allows reduction to a corotational formulation through a-posteriori simplifications of the governing equations. The conceptual equivalence of large deformation theories with corotational theories is also shown. The formulation is implemented into a stand-alone C-code software module where new ideas for finite element data structure and organization have been tested. Provisions for implementation on shared memory parallel computers have also been taken. This formulation appears suitable for static and dynamic modeling of large space structures, limit and post-critical analysis, simulation of large rotational maneuvering problems, and control-structure interaction problems. The effectiveness of the entire procedure is demonstrated with several numerical simulations. Dissert. Abstr.

N92-33989# Brookhaven National Lab., Upton, NY.
COMPARISON OF RADIATION SHIELDING PROPERTIES OF MATERIALS FOR SPACE EXPLORATION INITIATIVE
M. Divadeenam, C. L. Snead, Jr., T. E. Ward, and J. E. Nealy 1992 9 p Presented at the Nuclear Technologies for Space Exploration, Jackson, WY, 16-19 Aug. 1992
(Contract DE-AC02-76CH-00016)
(DE92-018165; BNL-47665; CONF-920803-15) Avail: CASI HC A02/MF A01

Radiation transport calculations were performed using the Monte Carlo Intranuclear Cascade Code LAHET in order to evaluate the shielding effectiveness of CH4 and CH2 materials compared with, water, aluminum, iron, and lead. In addition, calculations were performed using the deterministic straight-ahead approximation code BRYNTRN for CH4, CH2, B, C, Al, Fe, Ta, and Pb. The use of hydrogenous material is shown to be superior in its shielding properties of particle and energy spectra of SPE and for the GCR spectra. DOE

N92-34024*# Alabama Univ., Huntsville. Dept. of Chemistry.
RADIOACTIVE 7Be MATERIALS FLOWN ON LDEF Final Report, 13 Sep. 1991 - 12 Jul. 1992
John C. Gregory 12 Jul. 1992 9 p
(Contract NAS8-38609)
(NASA-CR-184385; NAS 1.26:184385) Avail: CASI HC A02/MF A01

Following the discovery of the atmospheric cosmogenic radionuclide Be-7 on the Long Duration Exposure Facility (LDEF), we began a search for other known nuclides produced by similar mechanisms. None of the others have the narrow gamma-ray line emission of Be-7 decay which enable its rapid detection and quantification. A search for Be-10 atoms on LDEF clamp plates using accelerator mass spectrometry is described. An unexpected result was obtained. Author

N92-34079# General Accounting Office, Washington, DC. National Security and International Affairs Div.
SPACE STATION: STATUS OF FINANCIAL RESERVES. REPORT TO THE CHAIR, GOVERNMENT ACTIVITIES AND TRANSPORTATION SUBCOMMITTEE, COMMITTEE ON GOVERNMENT OPERATIONS, HOUSE OF REPRESENTATIVES
Frank Degnan, Mona M. Zadjura, William W. Crocker, and James D. Berry, Jr. 20 Jul. 1992 6 p
(GAO/NSIAD-92-279; B-249408) Avail: CASI HC A02/MF A01; GAO, PO Box 6015, Gaithersburg, MD 20877 HC

The information on the financial reserves available to offset risks associated with the National Aeronautics and Space Administration's Space Station Freedom program is provided to Government Activities and Transportation Subcommittee of Committee on Government Operations House of Representatives, as requested. To obtain the information of the financial reserves NASA maintains in the space station program, NASA Headquarters officials in the Controller and Space Station program offices were interviewed. Financial and program documents related to the level of financial reserves in the program and the uses of those reserved to fund additional program requirements were reviewed. The review was conducted from March to July 1992 in accordance with generally accepted government auditing standards. As requested, written agency comments on this report was not obtained, but the reviews of responsible NASA officials were obtained to consider in preparing this report. I.I.C.

N92-34094*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION FREEDOM GATEWAY TO THE FUTURE
1992 30 p Original contains color illustrations
(NASA-NP-137; NAS 1.83:137) Avail: CASI HC A03/MF A01; 21 functional color pages

The first inhabited outpost on the frontier of space will be a place to live, work, and discover. Experiments conducted on Freedom will advance scientific knowledge about our world, our environment, and ourselves. We will learn how to adapt to the space environment and to build and operate new spacecraft with destinations far beyond Earth, continuing the tradition of exploration that began with a journey to the Moon. What we learn from living and working on Freedom will strengthen our expertise in science and engineering, promote national research and development initiatives and inspire another generation of Americans to push forward and onward. On the eve of the 21st century, Space Station Freedom will be our gateway to the future. This material covers gateways to space, research, discovery, utilization, benefits, and NASA. I.I.C.

N92-34153*# Space Systems/Loral, Palo Alto, CA.
CONTROL-STRUCTURE INTERACTION/MIRROR MOTION COMPENSATION Final Report
Mark McLaren, Peter Chu, and Xen Price Sep. 1992 130 p
(Contract NAS1-19242; RTOP 590-14-41-01)
(NASA-CR-189672; NAS 1.26:189672) Avail: CASI HC A07/MF A02

Space Systems/Loral (formerly Ford Aerospace, Space Systems Division) has implemented a rigid-body Mirror Motion Compensation (MMC) scheme for the GOES-I/M spacecraft currently being built for NASA and NOAA. This has resulted in a factor of 15 reduction in pointing error due to rigid-body spacecraft motion induced by the periodic black-body calibration maneuvers required for the instruments. For GOES the spacecraft and the payload mirrors are considered as rigid bodies. The structural flexibility effects are small and are included in the total pointing budget as a separate item. This paper extends the MMC technique to include structural flexibility. For large multi-payload platforms, the structural flexibility effects can be more important in sensor pointing jitter as the result of payload motion. Sensitivity results are included to show the importance of the dynamic model fidelity. Author

N92-34217*# Southern Research Inst., Birmingham, AL.
SRB THERMAL CURTAIN DESIGN SUPPORT Interim Report, 1 Apr. - 31 Oct. 1990
Wayne E. Lundblad Oct. 1990 117 p Prepared in cooperation with United States Polymeric Chemicals, Inc., Santa Ana, CA (Contract NAS8-38261)
(NASA-CR-184358; NAS 1.26:184358; SRI-MME-90-1030-7079)
Avail: CASI HC A06/MF A02

The objective during this time period was to perform a preliminary thermal analysis using some measured and estimated thermal properties on the angle-interlock materials. This preliminary thermal analysis is to serve as a guide for identifying any potential problems in blanket construction and identifying future tests.
Author

N92-33341*# Boeing Co., Seattle, WA.
COMMON MANNED MODULE
Dana Andrews *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 498-506 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

N92-33754# National Space Development Agency, Ibaraki (Japan).
REVIEW ON MANNED SERVICE PLATFORM (MSPF) [YUUJIN SABISU PURATTOFOMU (MSPF) NO KENTOU]
Yutaka Takano *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33755# Mitsubishi Electric Corp., Kamakura (Japan).
ELEMENT TECHNOLOGIES FOR MANNED SERVICE PLATFORMS [YUUJIN SABISU PURATTOFOMU NO YOUSO GIJUTSU]
Mitsuru Kojima, Hiroaki Obara, and Katsutoshi Oomura *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33756# Hitachi Ltd., Tokyo (Japan).
CONCEPTUAL DESIGN FOR MANNED SERVICE PLATFORMS [YUUJIN SABISU PURATTOFOMU NO GAINEN SEKKEI]
Shouichi Hoshina, Ryuusuke Abe, and Shigeru Kimura *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 23 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33763# Mitsubishi Space Software Corp. (Japan).
ANALYSIS OF SPACECRAFT ENTRY INTO MARS ATMOSPHERE [KASEI TAIKI TOTSUNYUU KAISEKI]
Ken Nakajima and Koutarou Nagano *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 23 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33793# Fuji Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON OPERATION CONCEPTS AND SEPARATION SIMULATION OF M-5 ROCKET VEHICLE AIR-LAUNCH PROGRAM [M-5 ROKETTO KUUCHUU HASSHA KEIKAKU NO UNYOU KOUSOU OYOBI RIDATSU SHIMYURESHON NO KENTOU]
Tadashi Ishikawa, Hidehiro Hirose, Yasuhiro Tani, and Yousuke Nagao *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE Prepared in cooperation with Tokyo Univ., Japan and Nissan Motor Co. Ltd., Tokyo, Japan (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33796# National Space Development Agency, Ibaraki (Japan). Launch Vehicle and Satellite System Lab.
FEASIBILITY OF MICROMINIATURE SATELLITES [CHOU KOGATA EISEI NO KANOU SEI NI TSUITE]
Ryouichi Imai *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 20 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33797# Mitsubishi Electric Corp., Tokyo (Japan).
STUDY ON MINIATURIZATION OF SATELLITES [EISEI KOGATA KA NO KENTOU]
Hiroaki Obara, Katsutoshi Oomura, and Osamu Saitou *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 21 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33855# Science and Technology Agency, Tokyo (Japan). Office of Space Utilization.
BASIC LINE OF SPACE STATION UTILIZATION
Junji Yoshihara *In its* The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 13-29 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

N92-33858# National Space Development Agency, Tokyo (Japan). Space Experiment Group.
PREPARATION FOR UTILIZING JEM
Tadaaki Mochida *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 81-116 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N92-33458# Centre National d'Etudes Spatiales, Toulouse (France).
TELESCIENCE [LA TELESCIENCE]
Jacques Breton *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 9-10 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N92-33872*# Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
PROCEEDINGS: NOZZLE INITIATIVE INDUSTRY ADVISORY COMMITTEE ON STANDARDIZATION OF CARBON-PHENOLIC TEST METHODS AND SPECIFICATIONS Final Report
William B. Hall 31 Aug. 1992 305 p Proceedings held in Metairie, LA, 14-15 May 1992
(Grant NAG8-545)
(NASA-CR-190620; NAS 1.26:190620) Avail: CASI HC A14/MF A03

Verbal discussions during the biannual meeting of the Industry

Advisory Committee for Carbon-phenolic constituent test methodology, which is constituted under the Solid Propulsion Integrity Program (SPIP), are addressed. The items on the agenda are: (1) NASA video tape library; (2) product code identification; (3) NMR progress; (4) IR and DMTA workshop; (5) aerospace database update; (6) M vision database demonstration; (7) constituent fingerprinting; (8) cured materials test development; (9) engineering needs for computer modeling; and (10) review action items. The materials prepared to support some of the oral presentations are also included in the Appendix. I.I.C.

N92-34113*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
DEPENDENCE OF HYDROGEN ARCJET OPERATION ON ELECTRODE GEOMETRY
Eric J. Pencil, John M. Sankovic, Charles J. Sarmiento, and John A. Hamley Sep. 1992 22 p Presented at the 28th Joint Propulsion Conference and Exhibit, Nashville, TN, 6-8 Jul. 1992; sponsored by AIAA, SAE, ASME, and ASEE
(RTOP 506-42-31)
(NASA-TM-105855; E-7311; NAS 1.15:105855; AIAA Paper 92-3530) Copyright Avail: CASI HC A03/MF A01

The dependence of 2 kW hydrogen arcjet performance on cathode to anode electrode spacing was evaluated at specific impulses of 900 and 1000 s. Less than 2 absolute percent change in efficiency was measured for the spacings tested which did not repeat the 14 absolute percent variation reported in earlier work with similar electrode designs. A different nozzle configuration was used to quantify the variation in hydrogen arcjet performance over an extended range of electrode spacing. Electrode gap variation resulted in less than 3 absolute percent change in efficiency. These null results suggested that electrode spacing is decoupled from hydrogen arcjet performance considerations over the ranges tested. Initial studies were conducted on hydrogen arcjet ignition. The dependence of breakdown voltage on mass flow rate and hydrogen arcjet ignition on rates of pulse repetition and pulse voltage rise were also included for comparison with previous results obtained using simulated hydrazine. Author

N92-34139*# Mississippi State Univ., Mississippi State. Dept. of Electrical and Computer Engineering.
MONTHLY PROGRESS REPORT
Robert J. Moorhead, II and Wayne Smith 3 Aug. 1992 44 p
(Grant NAG8-866)
(NASA-CR-190619; NAS 1.26:190619) Avail: CASI HC A03/MF A01

This report is the mid-year report intended for the design concepts for the communication network for the Advanced Solid Rocket Motor (ASRM) facility being built at Yellow Creek near Iuka, MS. The overall network is to include heterogeneous computers, to use various protocols, and to have different bandwidths. Performance consideration must be given to the potential network applications in the network environment. The performance evaluation of X window applications was given the major emphasis in this report. A simulation study using Bones will be included later. This mid-year report has three parts: Part 1 is an investigation of X window traffic using TCP/IP over Ethernet networks; part 2 is a survey study of performance concepts of X window applications with Macintosh computers; and the last part is a tutorial on DECnet protocols. The results of this report should be useful in the design and operation of the ASRM communication network. Author

N92-34198*# Memphis State Univ., TN. Dept. of Mechanical Engineering.
DYNAMIC MODELING OF SOLAR DYNAMIC COMPONENTS AND SYSTEMS Final Report
John I. Hochstein and T. Korakianitis (Washington Univ., Saint Louis, MO.) 14 Sep. 1992 509 p
(Grant NAG3-817)
(NASA-CR-190838; NAS 1.26:190838) Avail: CASI HC A22/MF A04

The purpose of this grant was to support NASA in modeling efforts to predict the transient dynamic and thermodynamic response of the space station solar dynamic power generation system. In order to meet the initial schedule requirement of providing results in time to support installation of the system as part of the initial phase of space station, early efforts were executed with alacrity and often in parallel. Initially, methods to predict the transient response of a Rankine as well as a Brayton cycle were developed. Review of preliminary design concepts led NASA to select a regenerative gas-turbine cycle using a helium-xenon mixture as the working fluid and, from that point forward, the modeling effort focused exclusively on that system. Although initial project planning called for a three year period of performance, revised NASA schedules moved system installation to later and later phases of station deployment. Eventually, NASA selected to halt development of the solar dynamic power generation system for space station and to reduce support for this project to two-thirds of the original level. Author

N92-34226*# Case Western Reserve Univ., Cleveland, OH. Dept. of Systems Engineering.
A TWO-LEVEL STRUCTURE FOR ADVANCED SPACE POWER SYSTEM AUTOMATION Final Report, Jun. 1987 - May 1990
Kenneth A. Loparo and Vira Chankong May 1990 75 p
(Grant NAG3-800)
(NASA-CR-190737; NAS 1.26:190737) Avail: CASI HC A04/MF A01

The tasks to be carried out during the three-year project period are: (1) performing extensive simulation using existing mathematical models to build a specific knowledge base of the operating characteristics of space power systems; (2) carrying out the necessary basic research on hierarchical control structures, real-time quantitative algorithms, and decision-theoretic procedures; (3) developing a two-level automation scheme for fault detection and diagnosis, maintenance and restoration scheduling, and load management; and (4) testing and demonstration. The outlines of the proposed system structure that served as a master plan for this project, work accomplished, concluding remarks, and ideas for future work are also addressed. I.I.C.

N92-33337*# TRW, Inc., Redondo Beach, CA. Space and Technology Group.
LOW PRESSURE-HIGH PERFORMANCE BOOSTER ENGINE TECHNOLOGY FOR ULTRA-LOW COST LAUNCH VEHICLES
Robert L. Sackheim *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 460-470
(For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33790# Nissan Motor Co. Ltd., Tokyo (Japan).
FLY-BACK BOOSTERS [FURAI BAKKU BUSUTA]
Takashi Makino and Seiji Matsuda *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 13 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33791# Kawasaki Heavy Industries Ltd., Kobe (Japan). Aerospace Group.
CONCEPTUAL STUDY ON VERTICALLY LAUNCHED FLY-BACK BOOSTERS [SUICHOKU UCHIAGE HOUSHIKI FURAI BAKKU BUSUTA NO GAINEN KENTOU]
Kouichi Yonemoto and Takashi Mugitani *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 23 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

23 CHEMISTRY AND MATERIALS (GENERAL)

N92-33619*# Hampton Univ., VA. Dept. of Chemistry.
THE SYNTHESIS OF MONOMERS WITH PENDENT ETHYNYL GROUP FOR MODIFIED HIGH PERFORMANCE THERMOPLASTICS Report, Sep. 1988 - 31 Aug. 1992
Godson C. Nwokogu, Miquel D. Antoine, and Omari Ansong Sep. 1992 19 p
(Grants NAG1-905; NSF RII-89-12609)
(NASA-CR-190821; NAS 1.26:190821) Avail: CASI HC A03/MF A01

The objectives of this project were to develop synthetic schemes for the following classes of modified monomers: (1) difunctional triarylethanes with pendent acetylenic groups; and (2) tertiary aspartimides with terminal acetylene groups at the two ends. Our efforts have resulted in the successful development of high yield schemes for the syntheses of several diamino and bisphenolic analogs of difunctional triarylethanes with pendent ethynyl group. A scheme for one new tertiary aspartimide was also established. Multi-gram samples of all prepared new monomers were provided to our technical contact at NASA-LaRC and preliminary polymerization studies were encouraging. Details of the accomplished work within the last four years are described.
Author

N92-33681# Harvard Univ., Cambridge, MA.
FUNDAMENTAL SPECTROSCOPIC STUDIES OF CARBENES AND HYDROCARBON RADICALS
P. Thaddeus and C. Gottlieb May 1992 3 p
(Contract DE-FG02-88ER-13912)
(DE92-014989; DOE/ER-13912/4) Avail: CASI HC A01/MF A01

This document details activities during this reporting period. Topics discussed are: The first spectroscopic identification of the HCCCO and DCCCO radicals; detection of new vibrationally excited states of the carbon chain radicals CCH and CCD and the three-membered carbene ring, cyclopropenylidene; determination of an accurate structure of the cumulene carbene H(sub 2)CCC; analysis the hyperfine structure in the SiC radical; and the undertaking of a systematic search for new sulfur bearing radicals.
DOE

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N92-33259# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
HIERARCHICAL CELLULAR MATERIALS
L. J. Gibson 1991 18 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-FG02-90ER-45422)
(DE92-015603; CONF-911202-81) Avail: CASI HC A03/MF A01

A method for estimating the contributions of both the composite and the cellular microstructures to the overall material properties and the mechanical efficiency of natural cellular solids is described. The method is demonstrated by focusing on the Young's modulus; similar techniques can be used for other material properties. The results suggest efficient microstructures for engineered cellular materials.
DOE

N92-33423*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ISOTHERMAL AGING OF IM7/8320 AND IM7/5260
Roderick H. Martin (Analytical Services and Materials, Inc., Hampton, VA.), Emilie J. Siochi (Lockheed Engineering and Sciences Co., Hampton, VA.), and Thomas S. Gates Aug. 1992 34 p Proposed for presentation at the 7th Technical Conference on Composite Materials, University Park, PA, 13-15 Oct. 1992
(RTOP 505-63-50-04)
(NASA-TM-107666; NAS 1.15:107666) Avail: CASI HC A03/MF A01

Isothermal aging was conducted on two composite systems being considered as possible candidates for the next generation supersonic transport. The composite systems were IM7/5260, a carbon/thermoset, and IM7/8320, a carbon/amorphous thermoplastic. The materials were isothermally aged for a total of 5000 hours at 125 C and 175 C. These temperatures are approximately equivalent to the upper skin temperatures of an aircraft flying at Mach 2.0 and Mach 2.4, respectively. The variations of the following properties were determined as a function of aging time: weight loss, moduli, glass transition temperature, microcracking, and modulus and strength of a +/- 45 laminate. The difficulties and accuracy of strain measurements are also discussed.
Author

N92-33492# Air Force Inst. of Tech., Wright-Patterson AFB, OH.
DEVELOPMENT OF A REAL-TIME FIBER ANALYZER: A FEASIBILITY STUDY M.S. Thesis
Philip J. Becker Mar. 1992 135 p
(AD-A252572; AFIT/CI/CIA-92-022) Avail: CASI HC A07/MF A01

The feasibility of creating an instrument which could distinguish fibrous particles from spherical particles and measure the dimensions of those fibers in real-time by modifying a TSI Aerodynamic Particle Sizer (APS) was examined. The main concept for the instrument is to align fibers so their polar axis is perpendicular to the incident laser beams in the APS. The pulse pairs generated can then be used to measure fiber length, diameter, and aerodynamic diameter.
GRA

N92-33496*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
STRUCTURAL ANALYSIS AND DESIGN OF GEODESICALLY STIFFENED COMPOSITE PANELS WITH VARIABLE STIFFENER DISTRIBUTION Report, Sep. 1990 - May 1992
B. Grall and Zafer Guerdal Aug. 1992 124 p
(Grant NAG1-643)
(NASA-CR-190608; NAS 1.26:190608; VPI-E-92-21; CCMS-92-24) Avail: CASI HC A06/MF A02

A computationally efficient analysis is developed to predict the critical buckling loads of a geodesically stiffened composite panel under in-plane loading. The analysis procedure accounts for the contribution of the in-plane extensional and out-of-plane bending stiffness of the stiffeners through the use of the Lagrange multipliers technique in an energy method solution. The analysis is used to understand the effect of various stiffener deformation modes on the buckling load and to determine skin deformation patterns of geodesically stiffened panels under various load combinations. The analysis routines are then coupled with the numerical optimizer ADS to create a package for the design of minimum-mass stiffened panels subject to constraints on buckling of the panel assembly and material strength failure. Material failure in the skin and stiffeners is estimated using a maximum strain criterion. The design variables that can be used for optimization include thickness of the skin laminate stiffness and height, and positions of straight stiffeners. Applied loads are uniaxial compression, pure shear, and combined compression-shear.
Author

N92-33544# Pittsburgh Univ., PA. Dept. of Mechanical Engineering.
THE MECHANICS OF PROGRESSIVE CRACKING IN CERAMIC MATRIX COMPOSITES AND LAMINATES Final Technical Report, Feb. 1989 - Sep. 1991
Norman Laws 30 Sep. 1991 101 p

(Grant AF-AFOSR-0104-88)
(AD-A252827; AFOSR-92-0669TR) Avail: CASI HC A06/MF A02

This report provides a brief summary of the principal results obtained in a research program on the mechanics of progressive cracking in ceramic matrix composites and laminates. The report concentrates on (1) progressive transverse matrix cracking in cross-ply laminates, (2) the effect of transverse matrix cracks on the axial response of unidirectional ceramic matrix composites, (3) thermal conductivities of hot pressed SiC/BN composites, (4) microcracking in polycrystalline ceramics, and (5) the effect of matrix cracking and fiber-matrix interfacial debonding on the response of unidirectional ceramic matrix composites. GRA

N92-33613*# Delaware Univ., Newark. Dept. of Mechanical Engineering.
CONTINUATION OF TAILORED COMPOSITE STRUCTURES OF ORDERED STAPLE THERMOPLASTIC MATERIAL Final Report
Michael H. Santare and R. Byron Pipes Sep. 1992 87 p
(Contract NAS1-18758; RTOP 510-02-12-01)
(NASA-CR-189671; NAS 1.26:189671) Avail: CASI HC A05/MF A01

The search for the cost effective composite structure has motivated the investigation of several approaches to develop composite structure from innovative material forms. Among the promising approaches is the conversion of a planar sheet to components of complex curvature through sheet forming or stretch forming. In both cases, the potential for material stretch in the fiber direction appears to offer a clear advantage in formability over continuous fiber systems. A framework was established which allows the simulation of the anisotropic mechanisms of deformation of long discontinuous fiber laminates wherein the matrix phase is a viscous fluid. Predictions for the effective viscosities of a hyper-anisotropic medium consisting of collimated, discontinuous fibers suspended in viscous matrix were extended to capture the characteristics of typical polymers including non-Newtonian behavior and temperature dependence. In addition, the influence of fiber misorientation was also modeled by compliance averaging to determine ensemble properties for a given orientation distribution. A design tool is presented for predicting the effect of material heterogeneity on the performance of curved composite beams such as those used in aircraft fuselage structures. Material heterogeneity can be induced during manufacturing processes such as sheet forming and stretch forming of thermoplastic composites. This heterogeneity can be introduced in the form of fiber realignment and spreading during the manufacturing process causing radial and tangential gradients in material properties. Two analysis procedures are used to solve the beam problems. The first method uses separate two-dimensional elasticity solutions for the stresses in the flange and web sections of the beam. The separate solutions are coupled by requiring that forces and displacements match section boundaries. The second method uses an approximate Rayleigh-Ritz technique to find the solutions for more complex beams. Analyses are performed for curved beams of various cross-sections loaded in pure bending and with a uniform distributed load. Preliminary results show that the geometry of the beam dictates the effect of heterogeneity on performance. The role of heterogeneity is larger in beams with a small average radius-to-depth ration, R/t, where R is the average radius of the beam and t is the difference between the inside and outside radii. Results of the anlysis are in the form of stresses and displacements and are compared to both mechanics of materials and numerical solutions obtained using finite element analysis. Author

N92-33622# Naval Postgraduate School, Monterey, CA.
PROBABILISTIC STRENGTH-LIFE MODEL FOR GRAPHITE FIBERS UNDER STRESS M.S. Thesis
Nigel I. Gardener Mar. 1992 119 p
(AD-A253023) Avail: CASI HC A06/MF A02

The work done in this investigation is part of a continuing program designed to develop probabilistic strength and life models for filament composite materials. In this particular experiment, groups of single fibers from two chemically identical different production spools of graphite were loaded to identical sustained tensile loads in order to determine their life statistics while under stress. While previous work has produced models of composite reliability as a function of strength, this work develops a model which will be necessary to predict the reliability of composite fibers as a function of time. Parametric and non-parametric methods were used to quantify the relationship between fiber reliability as a function of stress and as a function of time. GRA

N92-33663# Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
EFFECTS OF REPAIR PROCESSING ON THE MECHANICAL PROPERTIES OF THERMOPLASTIC MATRIX COMPOSITES Final Report
S. V. Hoa and X. R. Xiao Feb. 1992 132 p
(Contract DSS-W7708-8-9853)
(DREP-92-02; CTN-92-60594) Avail: CASI HC A07/MF A02

Issues relating to the repair of thermoplastic matrix composite materials are investigated. The effects of rapid heating and cooling cycles, typical of most remelting repair processes, on the crystalline morphology and interlaminar fracture toughness of APC-2 graphite polyether etherketone were examined. Methods for fusion bonding are reviewed and evaluated for repair applications. Results of repairs carried out by resistance welding and by inductive heating are presented and discussed in terms of their mechanical effectiveness and suitability as field repair procedures. A process for joining thermoplastic resin composite by resistance welding was developed with the aid of numerical thermal analysis. Resistance welding produced a lap shear strength of 33.3 +/- 4.2 megapascals on APC-2 cross-ply laminates. Induction heating can produce volumetric heating patterns, and it is preferable for patching type repair. A lap shear strength of 36.5 +/- 4.7 megapascals was obtained with a low pressure of 0.25 megapascals. Author (CISTI)

N92-33666# Atomic Energy of Canada Ltd., Pinawa (Manitoba).
ELECTRON-BEAM PROCESSING OF ADVANCED COMPOSITES Final Report
C. B. Saunders, V. J. Lopata, W. Kremers, T. E. McDougall, and M. Tateishi Dec. 1991 29 p
(Contract DSS-W7708-01-0914/01-XSA)
(DREP-91-29; CTN-92-60595) Avail: CASI HC A03/MF A01

Three resin formulations that would be suitable for fabricating radiation curable composites were selected: CN104, an epoxy acrylate; a blend of CN104 and dipenta erythritol penta acrylate; and FW3, a blend of epoxy acrylates and methacrylates. The optimum doses and dose rates for electron beam (EB) processing of these resins were then determined, and selected mechanical properties of the produced composites were measured. The flexural moduli of the composites were found to be as much as 10 gigapascals higher when using high dose rate EB curing than low dose rate x-rays. The glass transition temperature (T(sub g)) also increased by as much as 10 percent at the higher dose rate. At a given dose rate, the dose required to reach the maximum T(sub g) was about the same as the dose to obtain the maximum flexural modulus for all three resins, as long as the curing was done in a dry, inert atmosphere. The curing pressure and temperature had only a small effect on the composite density. The void content of the EB-cured laminates decreased with increased consolidation or curing pressure at 25 C. The FW3 composites had the lowest void content at 25 C. The radius of curvature of EB-cured laminates was up to 7 times greater than for thermally cured samples, illustrating the expected reduction in residual stresses.
Author (CISTI)

N92-33704*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SCALE EFFECTS ON THE TRANSVERSE TENSILE STRENGTH OF GRAPHITE EPOXY COMPOSITES
T. Kevin OBrien and Satish A. Salpekar Jun. 1992 60 p
Presented at the 11th ASTM Symposium on Composite Materials: Testing and Design, Pittsburgh, PA, 4-5 May 1992

(RTOP 505-63-50-04)
(NASA-TM-107637; NAS 1.15:107637; AVSCOM-TR-92-B-009)
Avail: CASI HC A04/MF A01

The influence of material volume on the transverse tensile strength of AS4/3501-6 graphite epoxy composites was investigated. Tensile tests of 90 degree laminates with 3 different widths and 5 different thicknesses were conducted. A finite element analysis was performed to determine the influence of the grip on the stress distribution in the coupons and explain the tendency for the distribution of failure locations to be skewed toward the grip. Specimens were instrumented with strain gages and extensometers to insure good alignment and to measure failure strains. Data indicated that matrix dominated strength properties varied with the volume of material that was stressed, with the strength decreasing as volume increased. Transverse strength data were used in a volumetric scaling law based on Weibull statistics to predict the strength of 90 degree laminates loaded in three point bending. Comparisons were also made between transverse strength measurements and out-of-plane interlaminar tensile strength measurements from curved beam bending tests. The significance of observed scale effects on the use of tests for material screening, quality assurance, and design allowables is discussed. Author

N92-33729# Manitoba Univ., Winnipeg.
DEVELOPMENT OF DUCTILIZED TITANIUM ALUMINIDES AS A MATRIX FOR HIGH TEMPERATURE, HIGH PERFORMANCE COMPOSITES
Kris Tangri Jun. 1991 167 p
(Contract DREP-W7708-0-0379/01-XSA)
(DREP-91-20; CTN-92-60581) Avail: CASI HC A08/MF A02

Research on the development of ductile aerospace alloys based on titanium aluminides is reported. These aluminides may serve as matrix materials for high temperature structural composites. As a background to consideration of the possible approaches to the design of such alloys, the pertinent developments in the field of nickel base superalloys is presented, given the many similarities in the Ti-Al and Ni-Al systems. The crystal structure of Ni3Al is described along with the types of lattice defects in these structures. The mechanical properties of NiAl and TiAl intermetallic single crystals and polycrystals at room temperature and at high temperatures are summarized. Some future studies on Ti-Al systems are proposed. Author (CISTI)

N92-33834 Northwestern Univ., Evanston, IL.
CHARACTERIZATION, DAMAGE MECHANICS, AND DAMAGE DEVELOPMENT OF COMPOSITE MATERIALS Ph.D. Thesis
Cho-Liang Tsai 1991 185 p
Avail: Univ. Microfilms Order No. DA9129078

Classical lamination theory and failure criteria are discussed. They describe the basic mechanical behavior of undamaged composite laminates and their failure. An interlaminar-shear-stress analysis for symmetric crossply composite laminates under monotonic loading was developed which gives general governing equations involving only displacements of each lamina for laminates with matrix cracks, drilling, or sectioning. Mechanical tests for characterization of composite materials were described systematically for obtaining engineering constants and other properties of the materials. Determination of in situ residual stresses of asymmetric composite laminates was also discussed. A series of problems dealing with symmetric composite laminates with matrix cracks under various types of in-plane loading were solved. Stress-strain relation, crack density, and properties affected by matrix cracking were predicted. Experiments were performed to prove the prediction with very good agreement. Further work was recommended including extending the interlaminar-shear-stress analysis to arbitrary layups, the fiber-matrix interaction problem, and the study of fatigue loading of composite laminates for life prediction. Dissert. Abstr.

N92-33838 Washington Univ., Seattle.
STATISTICAL STRENGTH MODELS FOR COMPOSITES WITH DISCONTINUITIES Ph.D. Thesis
Ming-Chih Cheng 1991 151 p
Avail: Univ. Microfilms Order No. DA9131622

This thesis investigates the microfracture process in laminated composites based on a problematic approach. Two probabilistic fracture models, a statistical model and a stochastic model, were developed for predicting the failure stress in composites containing geometric discontinuities such as holes and cracks. A two-parameter Weibull distribution of fiber strength and the elastic properties of matrix materials are used in the analysis. The results show that the fracture stress is related to notch size by a power law similar to that proposed by Mar and Lin. Experiments were conducted to verify the probabilistic fracture models developed. The strength reduction factors for boron/epoxy (0/-45/0/45)s laminates were obtained and the fiber damage near the hole edge was studied. The experimental data agree well with the predictions from the probabilistic fracture models. Dissert. Abstr.

N92-33852 Michigan State Univ., East Lansing.
THE EFFECT OF INTERFACE ON THERMO-MECHANICAL PROPERTIES OF COMPOSITES Ph.D. Thesis
Yihong Tong 1991 185 p
Avail: Univ. Microfilms Order No. DA9129509

The effect of interface on local stress and displacement fields and thermo-mechanical properties of composites is studied. The inclusions are assumed to be uniformly but non periodically distributed in the matrix. The interface is varied theoretically by considering two models. The first one is the flexible interface model, in which the continuity of tractions at the interfaces is maintained but there exist jumps in the displacements, such that the jumps in the tangential and normal displacements are proportional to shear tractions and normal tractions, respectively. Two parameters are introduced to describe the degree of adhesion between inclusion and matrix. Specific interface condition can be simulated by proper selection of the two parameters. The second model describes the interface as a layer between the inclusion and the matrix. This layer, called interphase, has a given thickness and the thermo-mechanical properties differ from those of the matrix and the inclusions. The elastic properties of the layer are assumed uniform or variable. The perfect bond is assumed at both the matrix-interphase and interphase-inclusion interfaces. For both of these interfacial representations, a unified approximate approach to evaluate the effective thermo-mechanical properties is used. Initially, the boundary value problem of the isolated inclusion embedded in the matrix is solved. Then, stress disturbance in the inclusion due to the presence of other inclusions is accounted for by using a successive iteration method (Mori and Wakashima, 1990) based on Mori-Tanaka theory (Mori and Tanaka, 1973). The successive iteration yields solutions that converge into closed forms under a certain condition. The analytical forms of the local stress and displacement fields and the effective properties are obtained. The latter are predicted by using the concept of the average strain in the composite. The approach is simple and can be easily extended to other boundary conditions and is valid for any shape. In the numerical results presented, the inclusions are assumed to be cylindrical or spherical in shape for simplicity. The influence of various mechanisms at the interface is studied and the results are compared with the perfect bonding case, bounds, as well as the other analytical results. Dissert. Abstr.

N92-33853 Northwestern Univ., Evanston, IL.
MICROMECHANICS OF FIBER-REINFORCED BRITTLE-MATRIX COMPOSITE MATERIALS Ph.D. Thesis
Chung-Chia Yang 1991 130 p
Avail: Univ. Microfilms Order No. DA9129090

The theory of micromechanics is used to investigate fracture mechanisms in fiber reinforced brittle-matrix composite materials. Experiments were carried out on cement based composite materials to validate the theoretical predictions. Mori-Tanaka theory and Eshelby's method were applied to obtain a more accurate evaluation of average elastic and elasto-plastic relationships of composite materials with spherical, prolate spheroidal and elliptic cylindrical inhomogeneities. A perfect bond was assumed between

the inclusions and the surrounding matrix. The Young's modulus of the composite material is given as a function of the volume fraction of fibers. Using the inclusion method, the toughening of composites by mixing strong continuous fibers into a brittle material has been examined. The fibers suppress the extension of a crack through bridging, interfacial debonding and sliding effects. The energy release rate of a fiber bridged crack and the resistance to crack extension by energy dissipation were evaluated separately to account for these effects. The crack size-external stress diagrams are presented in such a way that the stability and extension path of the bridged crack can be readily discerned. Experiments were carried out on cement based composite specimens with steel wires as fibers under uniaxial tension conditions. Tests were performed with different fiber diameters and fiber volume ratios. Theoretical considerations show that depending on the values of fiber volume ratio, fiber diameter, matrix and interfacial properties, a composite which is under tensile loading may or may not contain debonding at BOP (bend-over-point). A critical fiber volume fraction for debonding at BOP can be predicted from the present model. For a composite with debonding, an asymptotic solution for stress at BOP can be determined by the present model, whereas for a composite without debonding, both upper and lower bounds of stress at BOP can be predicted. Plots of the composite stress at BOP vs. volume ratio are given. Theoretical predictions show good agreement with the experimental results. Dissert. Abstr.

N92-33929# United Technologies Research Center, East Hartford, CT.

CARBON FIBER REINFORCED GLASS MATRIX COMPOSITES FOR SATELLITE APPLICATIONS Annual Report, Jan. 1989 - Jun. 1992

W. K. Tredway, P. H. McCluskey, and K. M. Prewo 30 Jun. 1992 90 p

(Contract N00014-89-C-0046)

(AD-A253018; UTRC-R92-917981-2) Avail: CASI HC A05/MF A01

The development of carbon fiber reinforced glass and glass-ceramic matrix composites for satellite applications is described. A variety of carbon fibers (HMU, P-100, FT700, K110OX) were used to reinforce borosilicate glass and BMAS glass-ceramics to create high performance composite materials useful for structural applications in space. Fundamental material properties that are described in this report include tensile and compressive stress-strain behavior, tensile and compressive fatigue behavior, effect of fiber orientation on tensile strength and elastic modulus, notch sensitivity, high temperature strength characteristics, thermal expansion behavior, thermal conductivity characteristics, and space environmental durability. Also included is a section describing methods that were developed for improving the tensile proportional limit in these materials as well as a section describing the application of hot isostatic pressing for the fabrication of structural components such as thin-walled tubes and angle brackets. The final section describes two satellite applications that were identified for carbon fiber reinforced glass composites, specifically tubes for satellite truss structures and radiator fins for space power applications. GRA

N92-33994# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).

STABILITY FAILURE OF SANDWICH STRUCTURES

G. Dreher (Eurocopter Hubschrauber G.m.b.H., Munich, Germany, F.R.) 1992 16 p Presented at the 2nd International Conference Construction, Gainesville, FL, 9-12 Mar. 1992

(MBB-UD-0613-92-PUB; ETN-92-92108) Avail: CASI HC A03/MF A01

Results of a theoretical and experimental study on different stability failure modes of plane sandwich structures subjected to compressive respectively flexural loading are presented. Depending on geometry and material properties of the structure different stability failure modes occur. In the theoretical studies several calculation methods capable of determining the critical linear buckling load are summarized and verified by FE (Finite Element) analysis. The experimental results are compared with the theoretical predictions (analytical methods and FE analysis). The comparison revealed a reasonably good correlation between theory and experiment. ESA

N92-33999 Delaware Univ., Newark.

THE ROLE OF MOLECULAR MOBILITY IN THE CONSOLIDATION AND BONDING OF THERMOPLASTIC COMPOSITE MATERIALS Ph.D. Thesis

Vivek Agarwal 1991 239 p

Avail: Univ. Microfilms Order No. DA9206348

The purpose of this research was to determine the role of molecular interdiffusion in the consolidation of thermoplastic composites and to determine whether the time required for interdiffusion would be a practical limitation on the maximum production rate that can be achieved in consolidation processes. The time required to consolidate thermoplastic composite materials was determined using isothermal compression molding and laser-assisted consolidation experiments; very short consolidation times, less than one second, were obtained using the laser process. Characterization of parts produced using the laser process included measuring interlaminar properties, void content, polymer degradation, and crystallinity. A nonisothermal diffusional bonding model was developed to determine whether the experimental interlaminar properties were consistent with a molecular interdiffusion mechanism. Model predictions were found to be consistent with experimental results. These results indicate that molecular diffusion can limit consolidation quality in processes such as the laser-assisted consolidation process. Theoretical self-diffusivities and relaxation times were calculated for the polymer resin using the reptation theory for polymer melts. These predictions were compared to experimental measurements of the relaxation times using rheometric experiments. The isothermal bonding time obtained from the laser consolidation experiments was comparable to the experimental relaxation times. Comparison of the theoretical predictions indicated that the bonding was controlled by the longer, less mobile chains in the resin system. Thermal analysis of the laser process provided insight into some of the processing limitations in on-line consolidation processes. A model for the absorption of the laser energy in the laser process was developed. An on-line consolidation model was developed to predict the interlaminar properties, based on limitations imposed by polymer interdiffusion. The effect of material properties and process configuration (heating source) on dwell time can be predicted using the model from which the consolidation quality can be determined. Dissert. Abstr.

N92-34000 Stanford Univ., CA.

DEPOSITION MECHANISMS AND PROFILE MODELING OF SiO2 FILMS DEPOSITED BY LOW-PRESSURE CHEMICAL VAPOR DEPOSITION Ph.D. Thesis

Lie-Yea Cheng 1991 98 p

Avail: Univ. Microfilms Order No. DA9205611

This research describes a new test structure that successfully separates the mechanisms controlling step coverage of low pressure chemical vapor deposition (LPCVD) SiO2 surface diffusion and re-emission due to a low reactive sticking coefficient of the reactive species. The new test structure has overhangs above a cavity which isolate most of the cavity from gas phase direct flux. Deposition in the shadowed area occurs either through surface diffusion or re-emission of species originating in the non-shadowed area. Variation in the geometry of the test structure allows us to determine the dominant mechanism. The results show that re-emission, not surface diffusion, is the dominant step coverage controlling mechanism for LPCVD SiO2 films deposited with oxygen and any one of four silicon sources: silane, diethylsilane (DES), tetraethoxysilane (TEOS) and 1,3,5,7 tetramethylcyclotetrasiloxane (TMCTS). This research also describes a Monte Carlo LPCVD profile simulator (part of SPEEDIE, Stanford Profile Emulator for Etching and Deposition in IC Engineering) which determines the relative importance of these two mechanisms and extracts surface diffusion lengths, L(sub d), and reactive sticking coefficients, S(sub c). The results show that only the reactive sticking coefficient is

required to accurately simulate the deposition profiles on test structures with different cavity heights and trenches with different aspect ratios. The values of S(sub c) differ for each silicon source. The more conformal films deposited with TEOS/oxygen or TMCTS/oxygen sources have lower sticking coefficients than the less conformal films deposited with silane/oxygen and DES/oxygen sources. This research also includes a study of the effects of temperature and pressure on S(sub c) and hence, step coverage. Temperature can improve or degrade step coverage depending upon the specifics of the surface reaction. The results suggest that the reactive species controlling silane/oxygen and DES/oxygen source oxide deposition are not silane or DES but precursor species originating from silicon sources. The study of the effect of pressure show that the Langmuir-Hinshelwood bimolecular surface reaction mechanism agrees well with the experimental results. Dissert. Abstr.

N92-34128# Rensselaer Polytechnic Inst., Troy, NY.
DEFORMATION AND DAMAGE MECHANISMS IN HIGH TEMPERATURE COMPOSITES WITH DUCTILE MATRICES Final Report
George J. Dvorak and Yeia A. Bahei-El-Din Jun. 1992 111 p
(Grant AF-AFOSR-0150-88)
(AD-A253437; AFOSR-92-0674TR) Avail: CASI HC A06/MF A01

This report presents a summary of the theoretical and experimental work performed in our research program on deformation and damage of high temperature composites. The theoretical part focused on two areas: modeling of fatigue damage in metal matrix composite and laminates by shakedown and nonlinear optimization, and refinement of the unified viscoplasticity theory formulated last year for homogeneous materials, in order to model certain phenomena observed in high temperature experiments of unreinforced metals. Implementation of the new viscoplasticity theory for the phases in the Periodic Hexagonal Array model for unidirectional composites was an important part of the research. Progress in these theoretical aspects of the program is summarized. The report also describes achievements in the experimental program. GRA

N92-34208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
HEAT TRANSFER DEVICE Patent Application
Bruce A. Banks, inventor (to NASA) and James R. Gaier, inventor (to NASA) 11 May 1992 11 p
(NASA-Case-LEW-14162-3; NAS 1.71:LEW-14162-3;
US-Patent-Appl-SN-880851) Avail: CASI HC A03/MF A01

Gas derived graphite fibers generated by the decomposition of an organic gas are joined with a suitable binder. This produces a high thermal conductivity composite material which passively conducts heat from a source, such as a semiconductor, to a heat sink. The fibers may be intercalated. The intercalate can be halogen or halide salt, alkaline metal, or any other species which contributes to the electrical conductivity improvement of the graphite fiber. The fibers are bundled and joined with a suitable binder to form a high thermal conductivity composite material device. The heat transfer device may also be made of intercalated highly oriented pyrolytic graphite and machined, rather than made of fibers. NASA

N92-34214*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LOW PRESSURE PROCESS FOR CONTINUOUS FIBER REINFORCED POLYAMIC ACID RESIN MATRIX COMPOSITE LAMINATES Patent Application
Tan-Hung Hou, inventor (to NASA) (Lockheed Engineering and Sciences Co., Hampton, VA.), Paul W. Kidder, inventor (to NASA) (Lockheed Engineering and Sciences Co., Hampton, VA.), Robert M. Baucom, inventor (to NASA), and Rakasi M. Reddy, inventor (to NASA) (Old Dominion Univ., Norfolk, VA.) 30 Jul. 1992 16 p
(Contract NAS1-19000; NAG1-569)
(NASA-Case-LAR-14954-1; NAS 1.71:LAR-14954-1;
US-Patent-Appl-SN-924689) Avail: CASI HC A03/MF A01

A low pressure processor was developed for preparing a well-consolidated polyimide composite laminate. Prepreg plies were formed from unidirectional fibers and a polyamic acid resin solution. Molding stops were placed at the sides of a matched metal die mold. The prepreg plies were cut shorter than the length of the mold in the in-plane lateral direction and were stacked between the molding stops to a height which was higher than the molding stops. The plies were then compressed to the height of the stops and heated to allow the volatiles to escape and to start the imidization reaction. After removing the stops from the mold, the heat was increased and 0 - 500 psi was applied to complete the imidization reaction. The heat and pressure were further increased to form a consolidated polyimide composite laminate. NASA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N92-33253# Air Force Inst. of Tech., Wright-Patterson AFB, OH.
SUPERCRITICAL FLUID EXTRACTION AND CHROMATOGRAPHY USING A LEE SCIENTIFIC SERIES 600 SFE/SFC SYSTEM M.S. Thesis
Timothy S. Green May 1992 99 p
(AD-A252601; AFIT/CI/CIA-92-035) Avail: CASI HC A05/MF A01

The Lee Scientific Series 600 supercritical fluid extractor and chromatography system has been evaluated for quantitative analytical chromatography and quantitative on- and off-line extraction using benzo(a)pyrene, pentachlorophenol, and naphthalene spiked silica samples. The silica was spiked by adding chemical/solvent solution with known chemical mass to the silica tumbling, drying under a hood at room temperature, and then remixing. The samples were split so other researchers could perform the traditional Soxhlet and tecator extraction procedures on the same material. The supercritical fluid extraction (SFE) and supercritical fluid chromatography (SFC) was conducted with high purity carbon dioxide as the carrier fluid and mobile phase. On-line extraction utilized a cryofocusing tee on the instrument to immobilize and concentrate the analytes during dynamic extraction of the sample. After the extraction was complete, the tee was thawed and the analytes impulse loaded on the chromatographic column. GRA

N92-33255# Sandia National Labs., Albuquerque, NM.
HIGH SPATIAL RESOLUTION MICROANALYSIS IN THE ANALYTICAL ELECTRON MICROSCOPE: A TUTORIAL
A. D. Romig, Jr. and J. R. Michael 1992 3 p Presented at the Annual Meeting of the Electron Microscopy Society (EMS) of America, Boston, MA, 16-21 Aug. 1992
(Contract DE-AC04-76DP-00789)
(DE92-010958; SAND-92-0603C; CONF-920819-5) Avail: CASI HC A01/MF A01

High spatial resolution x-ray microanalysis in the analytical electron microscope (AEM) describes a technique by which chemical composition can be determined on spatial scales of less than 50 nm. Dependent upon the size of the incident probe, the energy (voltage) of the beam, the average atomic number of the material being analyzed, and the thickness of the specimens at the point of analysis, it is possible to measure uniquely the composition of a region 2-20 nm in diameter. Conventional thermionic (tungsten or LaB6) AEM's can attain direct spatial resolutions as small as 20 nm, while field emission (FEG) AEM's can attain direct spatial resolutions approaching 2 nm. Recently, efforts have been underway to extract compositional information on a finer spatial scale by using massively parallel Monte Carlo

electron trajectory simulations coupled with AEM measurements. By deconvolving the measured concentration profile with the calculated x-ray generation profile, it is possible to extract compositional information at near atomic resolution. DOE

N92-33258# California Univ., Riverside.
DEVELOPMENT AND APPLICATION OF A MASS SPECTROMETRIC SYSTEM TO STUDY VOLATILE COMPONENTS OF FLUID INCLUSIONS Ph.D. Thesis
R. C. Sloan, Jr. Jun. 1992 81 p
(Contract DE-FG03-89ER-14088)
(DE92-015056; DOE/ER-14088/T2) Avail: CASI HC A05/MF A01

A quadrupole mass spectrometric system coupled with mechanical decrepitation was constructed and calibrated to study fluid inclusions from an active geothermal system. Fluid inclusions in Salton Sea Scientific Drilling Project well cores and ejects from flow tests were analyzed. Ion currents from selected mass/charge ratio numbers were measured for gases from ruptured inclusions in epidote, calcite, and hematite vein minerals from different depths. Water, carbon dioxide, hydrogen sulfide, sulfur dioxide, and Cl-C4(+) hydrocarbons and free nitrogen were analyzed. DOE

N92-33267# Alaska Univ., Fairbanks. Geophysical Inst.
PLASMA-INDUCED CONVERSION OF SURFACE-ADSORBED HYDROCARBONS
W. M. Sackinger 1992 26 p Presented at the US Department of Energy Contractor Review Meeting on Natural Gas Research and Development, Morgantown, WV, 5-6 May 1992
(Contract DE-FG21-90MC-27420)
(DE92-016719; DOE/MC-27420/92/C0038; CONF-920584-23)
Avail: CASI HC A03/MF A01

Experimental results are reported for an electrical device for direct conversion of methane into higher hydrocarbons. A microchannel plate is excited with electrons from a photoemissive source, and electron impact ionization of methane on the inner surfaces of the microchannels creates an ion feedback process. The resulting low-density plasma creates higher hydrocarbons when charged particles impact the surfaces at grazing incidence. The production of C2 to C8-containing gases was noted, with a selectivity for C2 of 39 percent in one case. The proportions of converted products and the conversion rates depend upon the electrical voltage, the microchannel geometry, and the operating pressure. Conversion rates increase with operating pressure. DOE

N92-33276# Army Armament Research, Development and Engineering Center, Watervliet, NY. Benet Lab.
DETERMINATION OF TRIVALENT CHROMIUM IN CHROMIUM PLATING SOLUTIONS USING A REDOX TITRATION AND INDICATOR Final Report
Samuel Sopok May 1992 16 p
(AD-A252857; ARCCB-MR-92020) Avail: CASI HC A03/MF A01

The chemical literature lacks a simple non-instrumental analytical method to determine and adequately monitor trivalent chromium in chromium plating solutions during the chromium plating process. In this report, a simple method for analyzing and monitoring trivalent chromium during the chromium plating process is presented. The optimum operating range of trivalent chromium is 0 to 7.5 g/1, and the resulting precisions are in the 0 to 1.5-g/1 range, providing adequate monitoring of these plating solutions supported by five years of testing. GRA

N92-33394# Naval Research Lab., Washington, DC.
NUMERICAL SIMULATIONS OF SPONTANEOUS IGNITION AND DETONATION IN PROPANE-AIR MIXTURES
Carolyn R. Kaplan and Elaine S. Oran 6 Jul. 1992 39 p
(AD-A252888; NRL/MR/6183-92-6994) Avail: CASI HC A03/MF A01

The spontaneous ignition and subsequent detonation of propane-air mixtures caused by a weak shock in a partially confined volume containing an obstacle are studied using time-dependent numerical simulations. The motivation for this work is two-fold: first, to examine potential hazards from a leaking storage container (an obstacle to the flow), and second, to study the fundamental interaction of a shock wave with an obstacle in an energetic ambient gas. The numerical model combines a solution of the compressible equations of fluid dynamics with a phenomenological chemical induction model for species conversion and energy release. Nonreactive simulations show how the obstacle partially blocks the flow such that one portion of the shock front reflects off of the obstacle and another portion is transmitted. Reactive-flow simulations of stoichiometric propane-air mixtures show spontaneous ignition behind the shock reflected from the obstacle and later transition to detonation in the direction of the transmitted wave. Computations performed to study the effect of obstacle height show that different physical mechanisms are responsible for the transition to detonation for the various obstacle sizes considered. Simulations in a mixture with variable stoichiometry around the obstacle, a more realistic picture of the physical scenario, show decay of the transmitted shock and then re-ignition as the shock reaches the stoichiometric region. Two separate areas of ignition eventually combine and transition to detonation. As this detonation propagates into the lean region far from the obstacle, it decays into a shock wave followed by a decaying flame front. GRA

N92-33429# New Mexico Univ., Albuquerque.
DETERMINATION OF SURFACE pK(SUB a) VALUES OF SURFACE-CONFINED MOLECULES DERIVITIZED WITH pH-SENSITIVE PENDANT GROUPS
Mark A. Bryant, Bryan J. Johnson, and R. M. Crooks 6 Jul. 1992 16 p
(Contract N00014-91-J-1991)
(AD-A253034; TR-2) Avail: CASI HC A03/MF A01

Two methods for in-situ electrochemical measurements of surface pKa values are reported. The methods are applied to surface-confined monolayers consisting of organomercaptan molecules derivitized with pH-sensitive pendant groups. The first technique relies upon pH-dependent electrostatic binding of redox probe molecules to the charged monolayer surface: the surface concentration of the probe molecules reflects the degree of surface protonation. The second method relates the differential capacitance of the monolayer-modified electrode surface to the surface pKa. The two methods yield essentially identical results and are consistent with a recently developed theoretical model. The surface pKa values of 4-mercaptopyridine and 4-aminothiophenol are 3.7 and 5.7, respectively. GRA

N92-33443# Rice Univ., Houston, TX.
INFRARED ABSORPTION SPECTROSCOPY AND CHEMICAL KINETICS OF FREE RADICALS
R. F. Curl and G. P. Glass Apr. 1992 10 p
(Contract DE-FG05-85ER-13439)
(DE92-014110; DOE/ER-13439/T3) Avail: CASI HC A02/MF A01

Propargyl radical has recently attracted interest because of its possible role in combustion and soot formation. At high temperatures it is not easily destroyed by dissociation nor by reaction with oxygen thus, it has been observed in significant concentrations in numerous pyrolysis and oxidation processes. During the last year, we have obtained the high resolution spectrum of the v(sub 1) acetylenic CH stretch of propargyl radical (HCCCH2) near 3322 cm(exp -1) using infrared laser kinetic spectroscopy at Doppler limited resolution. Propargyl is prepared by flash photolysis of propargyl bromide (or propargyl chloride) at 193 nm (ArF excimer) and its transient infrared absorption probed by a CW color center laser. We are beginning to investigate the kinetics of propargyl radical. The decay of the radical after the flash appears to be second order. The fine structure transition of the Br atom is accessible and when monitored under the same conditions appears to exhibit a simple first order decay suggesting that the Br atom is reacting with precursor propargyl bromide. Ketenyl radicals were produced by 193 nm excimer laser photolysis of ketene and probed with a tunable diode laser operating at 2014 cm(exp -1). Under

these conditions, any singlet methylene which may be formed should react with the precursor, ketene, at a rate fast enough to ensure its total removal from the photolysis cell within 1 (mu)s. In the presence of 2 to 8 Torr of O2, the ketenyl radical was observed to decay exponentially with time constants that ranged from 20 to 5 (mu)s. DOE

N92-33522# Brookhaven National Lab., Upton, NY.
DIRECT STUDIES OF THE THERMAL DECOMPOSITION OF N2O AND CO2 AND OF THE REACTION OF CO WITH O2
J. W. Sutherland, P. M. Patterson, and R. B. Klemm 1992 32 p Presented at the 24th International Symposium on Combustion, Sydney (Australia), 5-10 Jul. 1992
(Contract DE-AC02-76CH-00016)
(DE92-007183; BNL-46985; CONF-920707-17) Avail: CASI HC A03/MF A01

The thermal decompositions of N2O and CO2 was investigated by monitoring the kinetics of formation of O(P-3) atoms in the reflected shock regime using atomic resonance absorption spectrophotometry (A.R.A.S.). The temperature range was 1805 to 2379 K for N2O and 2332 to 2869 K for CO2. Total densities were 3-4 x 10(exp 18) molecules cm(exp -3) and hence the reported rate constants are at or near the low pressure limit for unimolecular decomposition. The results were expressed by the following Arrhenius equations: CO2 k(T) = (1.63 +/- 1.96) x 10(exp -8) exp(-122565 +/- 5183/RT) cu cm molecule(exp -1) s(exp -1) N2O k(T) = (6.02 +/- 2.81) x 10(exp 10) exp(-53397 +/- 1865/RT) cu cm molecule(exp -1) s(exp -1). Uncertainties in the Arrhenius expressions are given at the one standard deviation level and the mean deviations of the experimental data from the respective expression are +/- 18.6 percent and +/- 30.7 percent. Corresponding values for the reverse reaction, k(sub rev)(CO2) were computed from the expression k(sub for)/k(sub rev) = K(sub c). The value obtained for k(sub rev)(CO2) was (2.18 +/- 0.83) x 10(exp -34) cm(exp 6) molecule(exp -2) s(exp -1), independent of temperature from 2332 to 2869 K. Preliminary results are also reported for the direct determination of the rate constant for the reaction, CO + O2 yields CO2 + O, from measurements of the initial rate of formation of O(P-3) atoms. DOE

N92-33552# Stanford Linear Accelerator Center, CA.
FUTURE FACILITIES FOR LIGHT QUARK SPECTROSCOPY: A PERSPECTIVE BASED ON THE LASS EXPERIENCE
B. N. Ratcliff Oct. 1991 9 p Presented at the International Conference on Hadron Spectroscopy, College Park, MD, 12-16 Aug. 1992
(Contract DE-AC03-76SF-00515)
(DE92-007392; SU-SLAC-PUB-5719; CONF-920847-1) Avail: CASI HC A02/MF A01

Some desirable design features of a future facility for the study of light meson spectroscopy in hadroproduction are described and compared with what has been achieved by the LASS spectrometer. A few aspects of next-generation experiments using such a facility are also discussed, including final state sample sizes and performance requirements. The need for complementary production modes and decay channels, and the importance of a broad programmatic approach to the physics are stressed. DOE

N92-33557# McMaster Univ., Hamilton (Ontario). Dept. of Chemistry.
SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF NEW HIGH-VALENT INORGANIC FLUORINE COMPOUNDS AND THEIR OXIDIZING PROPERTIES, VOLUME 1 Final Report, 1 May 1987 - 30 Apr. 1991
G. J. Schrobilgen Feb. 1992 170 p
(Contract F49620-87-C-0049)
(AD-A252840; PL-TR-91-3108-Vol-1; AD-E201063) Avail: CASI HC A08/MF A02

Noble gas fluorine oxidizers of Neon, Krypton, Argon, and Xenon have been synthesized and characterized. KrF(+) and XeF(+) cations have been made with neutral organic bases. Kr-N and Kr-O bonded molecules are also synthesized and characterized. The hypervalent compounds ClF6(-) and XeF5(-) are made. The anions IF6O(-), TeF6O(2-), TeF7(-) and TeF8(2-) anions are also made. Proof that the ClF6(-) anion exists is also presented. The photoelectron spectra of XeF2, XeF4, and XeF6 are obtained using monochromatized synchrotron radiation. The synthesis and characterization of Sb(OTeF5)sub6(-) Et4N(+), and Bi(OTeF5) sub6(-) Et4N(+) salts is completed. Radiotracer experiments involving F-18 are also accomplished to show the inability to synthesize NF5 is due to mainly steric reasons. GRA

N92-33558# McMaster Univ., Hamilton (Ontario). Dept. of Chemistry.
SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF NEW HIGH-VALENT INORGANIC FLUORINE COMPOUNDS AND THEIR OXIDIZING PROPERTIES, VOLUME 2 Final Report, 1 May 1987 - 30 Apr. 1991
G. J. Schrobilgen Feb. 1992 124 p
(Contract F49620-87-C-0049)
(AD-A252841; PL-TR-91-3108-Vol-2; AD-E201064) Avail: CASI HC A06/MF A02

Noble gas fluorine oxidizers of Neon, Krypton, Argon, and Xenon have been synthesized and characterized. KrF(+) and XeF(+) cations have been made with neutral organic bases. Kr-N and Kr-O bonded molecules are also synthesized and characterized. The hypervalent compounds ClF6(-) and XeF5(-) are made. The anions IF6O(-), TeF6O(2-), TeF7(-) and TeF8(2-) anions are also made. Proof that the ClF6(-) anion exists is also presented. The photoelectron spectra of XeF2, XeF4, and XeF6 are obtained using monochromatized synchrotron radiation. The synthesis and characterization of Sb(OTeF5)sub6(-) Et4N(+), and Bi(OTeF5) sub6(-) Et4N(+) salts is completed. Radiotracer experiments involving F-18 are also accomplished to show the inability to synthesize NF5 is due to mainly steric reasons. GRA

N92-33559# McMaster Univ., Hamilton (Ontario). Dept. of Chemistry.
SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF NEW HIGH-VALENT INORGANIC FLUORINE COMPOUNDS AND THEIR OXIDIZING PROPERTIES, VOLUME 3 Final Report, 1 May 1987 - 30 Apr. 1991
G. J. Schrobilgen Feb. 1992 163 p
(Contract F49620-87-C-0049)
(AD-A252842; PL-TR-91-3108-Vol-3; AD-E201065) Avail: CASI HC A08/MF A02

Noble gas fluorine oxidizers of Neon, Krypton, Argon, and Xenon have been synthesized and characterized. KrF(+) and XeF(+) cations have been made with neutral organic bases. Kr-N and Kr-O bonded molecules are also synthesized and characterized. The hypervalent compounds ClF6(-) and XeF5(-) are made. The anions IF6O(-), TeF6O(2-), TeF7(-) and TeF8(2-) anions are also made. Proof that the ClF6(-) anion exists is also presented. The photoelectron spectra of XeF2, XeF4, and XeF6 are obtained using monochromatized synchrotron radiation. The synthesis and characterization of Sb(OTeF5)sub6(-) Et4N(+), and Bi(OTeF5) sub6(-) Et4N(+) salts is completed. Radiotracer experiments involving F-18 are also accomplished to show the inability to synthesize NFsub5 is due to mainly steric reasons. GRA

N92-33599*# Eloret Corp., Sunnyvale, CA.
THEORETICAL INVESTIGATION OF GAS-SURFACE INTERACTIONS Progress Report, 1 Nov. 1991 - 31 Jui. 1992
Kenneth G. Dyall 16 Sep. 1992 67 p
(Contract NCC2-552)
(NASA-CR-190743; NAS 1.26:190743) Avail: CASI HC A04/MF A01

The investigation into the appearance of intruder states from the negative continuum when some of the two-electron integrals were omitted was completed. The work shows that, provided all integrals involving core contracted functions in an atomic general contraction are included, or that the core functions are radially localized, meaningful results are obtained and intruder states do not appear. In the area of program development, the Dirac-Hartree-Fock (DHF) program for closed-shell polyatomic

molecules was extended to permit Kramers-restricted open-shell DHF calculations with one electron in an open shell or one hole in a closed shell, or state-averaged DHF calculations over several particle or hole doublet states. One application of the open-shell code was to the KO molecule. Another major area of program development is the transformation of integrals from the scalar basis in which they are generated to the 2-spinor basis employed in parts of the DHF program, and hence to supermatrix form. Particularly concerning the omission of small component integrals, and with increase in availability of disk space, it is now possible to consider transforming the integrals. The use of ordered integrals, either in the scalar basis or in the 2-spinor basis, would considerably speed up the construction of the Fock matrix, and even more so if supermatrices were constructed. A considerable amount of effort was spent on analyzing the integral ordering and tranformation for the DHF program. The work of assessing the reliability of the relativistic effective core potentials (RECPs) was continued with calculation of the group IV monoxides. The perturbation of the metal atom provided by oxygen is expected to be larger than that provided by hydrogen and thus provide a better test of the qualification of the RECPs. Calculations on some platinum hydrides were carried out at nonrelativistic (NR), perturbation theory (PT) and DHF levels. Reprints of four papers describing this work are included. I.I.C.

N92-33611* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ACOUSTOPHORESIS METHOD AND APPARATUS Patent
Joseph S. Heyman, inventor (to NASA) 15 Sep. 1992 8 p
Filed 17 Dec. 1990 Supersedes N91-28321 (29 - 20, p 3310)
(NASA-Case-LAR-13388-1; US-Patent-5,147,562;
US-Patent-Appl-SN-628062; US-Patent-Class-210-748;
US-Patent-Class-55-15; US-Patent-Class-55-277;
US-Patent-Class-210-222; US-Patent-Class-210-223;
US-Patent-Class-210-695; US-Patent-Class-210-767) Avail: US Patent and Trademark Office

A method and apparatus are provided for acoustophoresis, i.e., the separation of species via acoustic waves. An ultrasonic transducer applies an acoustic wave to one end of a sample container containing at least two species having different acoustic absorptions. The wave has a frequency tuned to or harmonized with the point of resonance of the species to be separated. This wave caused the species to be driven to an opposite end of the sample container for removal. A second ultrasonic transducer may be provided to apply a second, oppositely directed acoustic wave to prevent undesired streaming. In addition, a radio frequency tuned to the mechanical resonance and coupled with a magnetic field can serve to identify a species in a medium comprising species with similar absorption coefficients, whereby an acoustic wave having a frequency corresponding to this gyrational rate can then be applied to sweep the identified species to one end of the container for removal.
Official Gazette of the U.S. Patent and Trademark Office

N92-33624# California Univ., San Diego, La Jolla.
THEORIES OF TURBULENT COMBUSTION IN HIGH SPEED FLOWS Final Report, Apr. 1989 - Apr. 1992
P. A. Libby and F. A. Williams 20 Apr. 1992 10 p
(Grant AF-AFOSR-0310-89)
(AD-A253032; AFOSR-92-0673TR) Avail: CASI HC A02/MF A01

Since the Damkohler and Reynolds numbers, over the range of conditions relevant to supersonic hydrogen-air combustion, were found to be consistent with the combustion occurring in the reaction-sheet regime, detailed numerical integrations were performed on the structures of counterflow hydrogen-air diffusion flames, for pressures from 0.5 to 10 atm and air temperatures from 300 - 1200 K, at a hydrogen temperature of 300 K. The results showed extinction to occur at high enough rates of strain in most cases, but no extinction for air temperatures above about 1000 K. Reduced chemical-kinetic mechanisms were developed for simplifying the computations. The computed extinction strain rates were found to be in excellent agreement with experiments. Compressibility effects were taken into account, and the results are being worked into methods for describing turbulent combustion in high-speed flows. GRA

N92-33647# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Stroemungsmechanik und Aerodynamik.
EXPERIMENTAL EXAMINATIONS OF SHOCK INDUCED REAL GAS EFFECTS OF NITROGEN MONOXIDE Ph.D. Thesis [EXPERIMENTELLE UNTERSUCHUNGEN STOSSBEDINGTER REALGASEFFEKTE VON STICKSTOFFMONOXID]
Leonhard Moser 1990 129 p In GERMAN
(ETN-92-92105) Avail: CASI HC A07/MF A02

Using high resolution infrared diode laser absorption spectroscopy, the oscillation relaxation and the thermal decomposition of nitrogen monoxide were time-resolved examined in homogeneous nitrogen monoxide argon mixtures, behind vertical shock waves. The results showed that the oscillation relaxation of nitrogen monoxide depended on the molecular rotation state. The temperature in the dissociation zone of the nitrogen monoxide molecule was measured using the two line absorption method. The results of the chemical, kinetic investigations showed that measurements behind falling shock waves are as reliable as measurement behind reflected shocked waves. Fundamental data were obtained, which are of importance in various fields of the technique, e.g., reentry in the Earth atmosphere for combustion processes. ESA

N92-33665 National Physical Lab., Teddington (England). Materials Metrology Div.
TEST METHODS FOR CORROSION INHIBITORS
P. E. Francis Mar. 1992 16 p
(NPL-DMM(A)-64; ETN-92-91991) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

The main findings of a comprehensive review of test methods for corrosion inhibitors are summarized and the more recent developments are considered. Parameters which need to be addressed to succesfully measure the effectiveness of corrosion inhibitors are discussed. The range of test methods is large with many methods highly specific to the application or product. Reproducibility is often poor. ESA

N92-33667 National Physical Lab., Teddington (England). Materials Metrology Div.
REVIEW OF MODELLING OF PIT PROPAGATION KINETICS
A. Turnbull Mar. 1992 35 p Sponsored by Dept. of Trade and Industry
(NPL-DMM(A)-65; ETN-92-91992) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

A critical evaluation of empirical and mechanistically based modeling of pit propagation kinetics is presented. Empirical models of pit growth kinetics based on the application of Faraday's law to measurement of the total current flowing to potentiostatically controlled specimen's have the limitation that only average properties are measured and have limited practical relevance. Extreme value statistics applied to materials exposed for varying periods of time provide a more effective method of prediction of maximum pit depths at a given time. However, the approach assumes that the material and environmental conditions are nominally constant in the regions of interest, and it is difficult to account for variations in conditions with time. Mechanistically based models are more flexible and more informative from the view point of understanding. However, absolute prediction of pit growth kinetics in service conditions is uncertain because of specific limitations in input data. An implicit fitting to experimental data is often a necessary requirement. The complementary use of statistically based empirical models and the more sophisticated mechanistically based models provides the most effective approach to prediction of pit growth kinetics over extended periods. ESA

N92-33683# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
CONTINUOUS CHEMICAL REACTION CHROMATOGRAPHY

R. Aris and R. W. Carr 1992 20 p
(Contract DE-FG02-84ER-13256)
(DE92-015100; DOE/ER-13256/6) Avail: CASI HC A03/MF A01

The past three years have been devoted to investigating simulated countercurrent chomatographic moving bed separators (SCMCS) and simulated countercurrent moving bed reactors (SCMCR). These are novel separators and reactors used for separation, or for carrying out a chemical reaction and separation continuously and simultaneously in fixed bed. In the SCMCR and the SCMCS the process aspects of a countercurrent moving bed, in which a stream of solids flows countercurrent to an inert fluid and past stationary reactant inlet, is simulated by successively switching feed and product take-off streams through a series of inlets located at fixed intervals along a fixed bed or between a series of packed columns. The flow of solids past a fixed feed point, characteristic of countercurrent moving beds, is replaced by motion of the feed past a fixed packed bed. Feed enters a particular column for a fixed length of time, and then is switched to the next column. Product streams are also advanced simultaneously. When the feed point has progressed to the end it is returned to the starting position and the process repeated. The shifting of the feed and the product positions in the direction of fluid flow thus simulates the movement of solids in the opposite direction. The requisite motion between the feed and the bed, which is continuous for true countercurrency, is replaced by periodic, discrete steps in simulated countercurrency. The continuous, steady state operation characteristic of true countercurrency is replaced by periodic transients at each switch of the feed. DOE

N92-33822 Washington State Univ., Pullman.
THE EFFECTS OF ELECTRICAL ENHANCEMENT ON PULSATING INSTABILITIES IN DETONATING GAS Ph.D. Thesis
Yang Yang 1990 217 p
Avail: Univ. Microfilms Order No. DA9131114

An investigation of the instability of pulsating detonation waves with electrical enhancement is presented. One dimensional inviscid flow with a single irreversible chemical reaction is considered. The numerical algorithm developed is a Godunov-Glimm type scheme. The chemical reaction equation is integrated while the reactive Riemann problem is solved such that the chemical reaction is coupled with the fluid dynamic equation. Both reactive shock and rarefaction waves are treated when a reactive Riemann problem is solved. The Glimm random choice method is used to evaluate the Riemann solution for the desired grid points. The algorithm is also extended to the detonation problem with viscosity. The testing problems show this algorithm has advantages that other algorithms do not have. Several new parameter studies (such as CJ detonation and under-driven detonations) to investigate the pulsating instability boundaries of detonation are performed. The calculated results show that the chemical reaction rate of the system plays an important role in the instability of detonation. Both activation energy, E+, and degree of overdrive, f, affect the chemical reaction rate of a system. The effects of electricity on the instability of pulsating detonation is examined. The addition of a small amount of electrical energy relative to chemical reaction energy released in the reaction process suppresses the normal pulsating pattern and stabilizes the system. Dissert Abstr.

N92-33842 Exeter Univ. (England).
THE BOUNDARY CONDITIONS FOR QUANTUM EVAPORATION IN LIQUID He-4 Ph.D. Thesis
Mark Gregory Brown 1990 164 p
Avail: Univ. Microfilms Order No. BRDX93128

Quantum evaporation is the desorption of single atoms from the surface of liquid He-4 by single bulk excitations. In previous experiments, a heat pulse was injected into the liquid and directed at the free surface. Both the time of flight and the angular distribution of the evaporated atoms were measured, and the results were found to be generally consistent with the assumption that desorption is by a single excitation-to-single atom process, in which the energy and the component of momentum parallel to the surface are conserved. The present experiments use the same techniques to examine these boundary conditions on energy and momentum in detail, for a large range of angles of incidence and evaporation. For the type of heater used here, it is found that the choice of input pulse power and duration is very important in determining whether phonons or rotons dominate the distribution of injected excitations, and whether the excitations propagate ballistically to the surface. Using appropriately chosen input pulses, the distributions of atoms evaporated by phonons and R(+)rotons (those rotons with wavevectors greater than that at the roton minimum) are found to be described well by the quantum evaporation model. From both the present measurements and those made previously, there is no evidence of atoms evaporated by R(-)rotons (those rotons with wavevectors less than that at the roton minimum). It is also found that the measured minimum signal time for the phonon-to-atom process is significantly shorter than the value calculated for the experimental arrangement used, in which the phonon and atom path lengths are the equal. This difference cannot be accounted for by experimental uncertainties and is probably due to the details of the propagation of the phonons in the bulk liquid. Dissert. Abstr.

N92-33844 Houston Univ., TX.
PERIODIC AND CHAOTIC MODES IN PREMIXED LAMINAR FLAMES Ph.D. Thesis
Mohamed Abbes el-Hamdi 1991 171 p
Avail: Univ. Microfilms Order No. DA9131262

We report the discoveries of many periodic and chaotic models of laminar premixed flames on porous plug burners. This report is the first confirmation of predictions of a number of recent theoretical studies on the dynamics of premixed flames. The experimental innovations and techniques presented in section 3.6 are the heart of the discoveries of these dynamical modes. In our experiment, a flame front is stabilized on a porous plug burner enclosed within a pyrex chamber. By varying the total flow rate, the stoichiometry of the combustible mixture, and the chamber pressure, we discovered many periodic and chaotic modes. We show that different fuels and/or oxidizers as well as the symmetries of the system can affect the dynamics of the flame front. Experimental evidence is presented that shows that laminar pre-mixed flames exhibit low-dimensional, deterministic chaos. The largest Liapunov exponent and the pointwise dimension calculations are used to confirm that chaos exists in certain regions of parameter space. We also describe a power spectrum technique that can be used to identify deterministic dynamics in real time. With the help of a spectrum analyzer, an experimentalist can map the dynamics (simple and complex) of the system under investigation in a relatively short time. As far as we know, this is the first time that nonlinear dynamics techniques are used to analyze experimental data from combustion. All the nonperiodic modes that we have discovered exhibit low-dimensional deterministic chaos and we believe that this result is a general one for propagating fronts. The implication of our work is that such nonperiodic states can be described by a tractable set of ordinary differential equations. Dissert. Abstr.

N92-34054# Grambling State Univ., LA.
NQR-NMR STUDIES OF HIGHER ALCOHOL SYNTHESIS Cu-Co CATALYSTS
14 Jan. 1992 8 p
(Contract DE-FG22-89PC-89761)
(DE92-015784; DOE/PC-89761/T7) Avail: CASI HC A02/MF A01

The primary objective of the project is to examine the relations between the catalytic and magnetic properties of the copper-cobalt higher alcohol synthesis catalysts. We have undertaken to investigate the magnetic character by studying the Nuclear Quadrupole Resonance of copper and (Zerofield) Nuclear Magnetic Resonance of cobalt in copper cobalt catalysts. DOE

N92-34074# Lehigh Univ., Bethlehem, PA.
BINDING AND CATALYTIC REDUCTION OF NO BY TRANSITION METAL ALUMINOSILICATES

K. Klier, R. G. Herman, and S. Hou Mar. 1992 11 p
(Contract DE-FG22-89PC-89784)
(DE92-015420; DOE/PC-89784/10) Avail: CASI HC A03/MF A01

The objective of this research is to provide the scientific understanding of processes that actively and selectively reduce NO in dilute exhaust streams, as well as in concentrated streams, to N2. Experimental studies of NO chemistry in transition metal-containing aluminosilicate catalysts are being carried out with the aim of determining the chemical rules for NO reduction on non-precious metals. DOE

N92-34088# Pennsylvania State Univ., University Park. Dept. of Chemical Engineering.
ENHANCEMENT OF ACTIVITY AND SELECTIVITY BY METAL-SUPPORT INTERACTIONS (MSI)
M. A. Vannice Jul. 1991 27 p
(Contract DE-FG02-84ER-13276)
(DE92-016203; DOE/ER-13276/T5) Avail: CASI HC A03/MF A01

This report contains sections on: toluene and xylene hydrogenation over Pd, benzene and toluene hydrogenation over Pt, hydrogenation reactions over Au, CO oxidation over Au, hydrogenation of acetophenone over Pt, and ultrahigh vacuum study of Pt/TiO2 systems. DOE

N92-34132# Department of the Navy, Washington, DC.
NMR IMAGING WITH VARYING SPATIAL COUPLING Patent Application
David G. Cory, inventor (to Navy), J. B. Miller, inventor (to Navy), and A. N. Garroway, inventor (to Navy) 10 Jan. 1992 13 p
(AD-D015269; US-Patent-Appl-SN-818939; Navy-Case-72495)
Avail: CASI HC A03/MF A01

A method for obtaining a nuclear magnetic resonance image of a sample is performed by first placing the sample in a homogeneous static magnetic field excited with a homogeneous transmitter device. Spin magnetization in the sample is, thus, initially detected with an inhomogeneous receiver device such that an induced voltage in the receiver device depends on a spatial location of precessing nuclei in the sample. Then, a spatial coupling of the sample and the receiver device is varied and the spin magnetization in the sample is again detected with the inhomogeneous receiver device. The full spatial distribution of the spin density of the sample and hence an image of the sample is then determined with the spin magnetizations detected. Either the sample is moved relative to the receiver device, or the spatial coupling of the receiver device and the sample is electronically altered. Any spin interactions are eliminated by using coherent averaging techniques before the detecting steps. In addition, during the varying step, the spin magnetization is either left in the transverse plane; stored along the static magnetic field direction; allowed equilibrate along the static magnetic field direction; or spin locked. GRA

N92-34133*# Colorado Univ., Boulder. Joint Inst. for Lab. Astrophysics.
LABORATORY STUDIES OF LOW TEMPERATURE RATE COEFFICIENTS: THE ATMOSPHERIC CHEMISTRY OF THE OUTER PLANETS Semiannual Status Report
Stephen R. Leone 29 Jun. 1992 12 p
(Grant NAGw-2438)
(NASA-CR-190622; NAS 1.26:190622) Avail: CASI HC A03/MF A01

The purpose of the project is to perform laboratory measurements of reaction rate coefficients at low temperature. The reactions and temperatures of interest are those that are important in the chemistry of the hydrocarbon rich atmospheres of the outer planets and their satellites. In this stage of the study we are investigating reactions of ethynyl radicals, C2H, with acetylene (C2H2), methane (CH4), and hydrogen (H2). In the previous status report from 24 Jan. 1992, we reported on the development of the experimental apparatus and the first, preliminary data for the C2H + C2H2 reaction. Author

N92-34157# Physical Sciences, Inc., Andover, MA.
OPTICAL DIAGNOSTICS IN SUPERSONIC COMBUSTING SYSTEMS Final Report, Dec. 1988 - Jul. 1991
T. E. Parker, M. G. Allen, S. J. Davis, K. Donohue, and R. R. Foutter Apr. 1992 169 p
(Contract F33615-88-C-2907)
(AD-A253463; PSI-1067/TR-1133; WL-TR-91-2101) Avail: CASI HC A08/MF A01

The development of supersonic combusting ramjet (SCRAMJET) engines requires testing using new, nonintrusive, instrumentation methods in high-speed, high-enthalpy flow facilities. This report describes a test series using a shock tunnel to produce Mach 3.0 flows with stagnation temperatures in excess of 3000 K and an optical diagnostic set specifically tailored for measurements in supersonic high temperature systems. The test facility includes a hydrogen injection capability which makes combustion tests possible for these flows. The report describes the shock tunnel and its capabilities, provides an overview of the optical diagnostics used in the test, and discusses the results of both combusting and noncombusting tests. The optical measurements include concentration and vibrational temperature for NO upstream of the combustion region (via spectrally resolved emission measurements), Planar Laser Induced Fluorescence (PLIF) imaging of both NO and OH (yielding either concentration or temperature information), and Schlieren photography. In addition, an OH absorption measurement strategy is discussed. This diagnostic set is particularly appropriate since it includes both line-of-sight and spatially resolved measurements and additionally, comparison of results form each of the techniques is possible. GRA

N92-34206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
GRAPHITE FLUORIDE FROM IODINE INTERCALATED GRAPHITIZED CARBON Patent Application
Ching-Cheh Hung, inventor (to NASA) 15 May 1992 14 p
(NASA-Case-LEW-15360-1; NAS 1.71:LEW-15360-1;
US-Patent-Appl-SN-884097) Avail: CASI HC A03/MF A01

Graphite fluoride is produced from graphitized carbon. A bromine iodine mixture reacts with graphitized carbon to produce iodine intercalated graphitized carbon that is then exposed to fluorine. NASA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N92-33256# Oak Ridge National Lab., TN.
SEGREGATION IN A NEUTRON-IRRADIATED TYPE 316 STAINLESS STEEL
E. A. Kenik and M. G. Burke (Westinghouse Electric Corp., Pittsburgh, PA.) 1992 2 p Presented at the Annual Meeting of the Electron Microscopy Society (EMS) of America, Boston, MA, 16-21 Aug. 1992
(Contracts DE-AC05-84OR-21400; DE-AC05-76OR-00033)
(DE92-011039; CONF-920819-10) Avail: CASI HC A01/MF A01

Radiation-induced segregation (RIS) and associated irradiation-assisted stress corrosion cracking (IASCC) of austenitic alloys may be a major factor in limiting component lifetimes in water-cooled nuclear reactors. There are some similarities between radiation-induced sensitization/IASCC and thermally-induced sensitization/intergranular stress corrosion cracking. Both processes are associated with chromium depletion at grain boundaries. Segregation to boundaries in a neutron irradiated type 316 stainless steel has been investigated with both energy-dispersive x-ray spectrometry (EDXS) and parallel detection electron energy loss spectrometry (PEELS). This report discusses work on segregation in a neutron-irradiated SS-316 sample. DOE

N92-33297# Argonne National Lab., IL.
CORROSION RESISTANCE OF IRON ALUMINIDES
K. Natesan Apr. 1992 13 p Presented at the 6th Annual Fossil Energy Materials Conference, Oak Ridge, TN, 12-14 May 1992
(Contract W-31-109-eng-38)
(DE92-016193; ANL/CP-75786; CONF-9205123-8) Avail: CASI HC A03/MF A01

Iron aluminides are being developed for use as structural materials and/or cladding alloys in fossil energy systems. Extensive development has been in progress on Fe3Al-based alloys to improve their engineering ductility. This paper describes the corrosion performance of these alloys, determined at Argonne National Laboratory, in environments that simulate coal gasification and fluidized-bed combustion. Thermogravimetric analysis (TGA) was conducted at temperatures of 650 - 1000 C in air, 1 vol. percent CO-CO2, and H2-H2S environments at two sulfur activities. Upon completion of the kinetic runs, the morphology and structure of the scales formed on the alloy surface were evaluated by scanning electron microscopy and energy-dispersive X-ray analysis. Corrosion tests in simulated combustion environments were conducted at 900 C in the presence of reagent-grade CaSO4 and circulating-fluidized-bed deposits for 1000 and 3000 h. The test data on the aluminides from the TGA and combustion tests were compared with the corrosion performance of Type 310 stainless steel tested under similar conditions. DOE

N92-33302# Naval Postgraduate School, Monterey, CA.
PREPARATION OF EXTINCTION FREE GAMMA Ti-51 AT. PERCENT Al ALLOY POWDER AND CHARACTERIZATION BY X RAY DIFFRACTION M.S. Thesis
Troy A. Stoner Mar. 1992 78 p
(AD-A252969) Avail: CASI HC A05/MF A01

The lattice parameters, structure factors, and Debye-Waller temperature factor of a homogenized, binary Ti-51 at. percent Al intermetallic alloy were determined using powder X-ray diffraction (XRD). Previous studies were hampered by extinction at low Bragg angles, therefore improved powdering methods were implemented. The powder was produced by pulverizing lathe turnings taken from the sample ingot using a ceramic mortar and pestle. Next, the powder was passed through a U.S. Standard 400 sieve mesh (38 microns). After further grinding a new acoustical sieving procedure was performed where powder particles were passed through a 2000 line per inch sieve mesh (5-7 microns). Next the powder was annealed to relieve induced stress produced during grinding. An X-ray diffraction study was conducted for Bragg angles of 10 - 140 deg. The L1 structured TiAl lattice parameters of a = 4.002 and c = 4.081 were determined using XRD peak positions. The resulting c/a ratio equalled 1.02. The measured integrated intensities of the fundamental reflections were used to determine a Debye-Waller temperature factor of B = 0.65 using the Wilson method. These values were determined to be accurate based on comparison to previous research and theoretical approximations. The effects of extinction at low angles were not completely avoided with the refined powder particle size however, they were significantly reduced. GRA

N92-33446# Oak Ridge National Lab., TN.
AN APFIM SURVEY OF GRAIN BOUNDARY SEGREGATION AND PRECIPITATION IN IRRADIATED PRESSURE VESSEL STEELS
M. K. Miller (Westinghouse Electric Corp., Pittsburgh, PA.) and M. G. Burke 1992 13 p Presented at the 16th Annual Symposium of American Society of Testing and Materials (ASTM), Denver, CO, 21-22 Jun. 1992
(Contract DE-AC05-84OR-21400)
(DE92-014177; CONF-920673-4) Avail: CASI HC A03/MF A01

Atom probe field ion microscopy has revealed that excessive copper levels in pressure vessel steels result in the formation of ultrafine copper-enriched clusters and precipitates during in-service neutron irradiation. In addition to these important clusters and precipitates, this technique has revealed many other fine-scaled microstructural features in these steels. These microstructural features may be divided into two broad categories: (1) intragranular precipitates and clusters; and (2) interfacial segregation. The precipitates and clusters include spherical, rod-shaped with disk-shaped molybdenum and vanadium carbides, disk-shaped molybdenum nitrides, and spherical iron oxides. The type of precipitate is dependent on the metallic additions that are made to the various types of steels used in the pressure vessel. Some of these features are present in approximately the same number density and size as the copper clusters and precipitates and will therefore make a contribution to the mechanical properties. The characterization of grain boundaries and precipitate/matrix interfaces has revealed a complex pattern of segregation of various solutes including phosphorus, nickel, and manganese. DOE

N92-33603*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE EFFECT OF WELD POROSITY ON THE CRYOGENIC FATIGUE STRENGTH OF ELI GRADE Ti-5Al-2.5Sn
P. R. Rogers, R. C. Lambdin, and D. E. Fox Sep. 1992 24 p
(NASA-TM-103602; NAS 1.15:103602) Avail: CASI HC A03/MF A01

The effect of weld porosity on the fatigue strength of ELI grade Ti-5Al-2.5Sn at cryogenic temperature was determined. A series of high cycle fatigue (HCF) and tensile tests were performed at -320 F on specimens made from welded sheets of the material. All specimens were tested with weld beads intact and some amount of weld offset. Specimens containing porosity and control specimens containing no porosity were tested. Results indicate that for the weld configuration tested, the fatigue life of the material is not affected by the presence of spherical embedded pores.
Author

N92-33664 National Physical Lab., Teddington (England). Materials Metrology Div.
TEST METHODS FOR TESTING AND PREDICTING PITTING SUSCEPTIBILITY OF METALLIC MATERIALS
P. E. Francis Mar. 1992 20 p
(NPL-DMM(A)-63; ETN-92-91990) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

The range of test methods described in the literature for measurement of the susceptibility of metallic materials to pitting corrosion are reviewed together with standard test methods where they exist. Accelerated measurement methods include simple chemical techniques and the more complex electrochemical methods. Although the chemical techniques are the least representative of natural conditions, they are the most frequently used as inhouse performance tests, whereas the electrochemical methods are favored for the more in depth studies found in the scientific literature. None of the methods can give an absolute measure of pitting susceptibility but provide ranking data for metallic materials. These methods do not give information on pit kinetics and service life. ESA

N92-33673# Army Armament Research, Development and Engineering Center, Watervliet, NY. Benet Lab.
SELF-ORGANIZED CRITICALITY AND THE BARKHAUSEN EFFECT Final Report
P. J. Cote and L. V. Meisel Apr. 1992 14 p Presented at the Army Research Office Workshop on Fractals, Research Triangle Park, NC, 23 May 1992
(AD-A252761; ARCCB-TR-92019) Avail: CASI HC A03/MF A01

The Barkhausen effect was studied in an amorphous alloy. The data exhibit all the attributes of self-ordered critical behavior enumerated by earlier works; the distribution of lifetimes and areas of discrete Barkhausen pulses follow powerlaw distributions, which have been modified to account for finite-size effects. The directly measured power spectral density has the form of flicker noise, with exponent and form consistent with those to be expected from the measured distribution of pulse areas and lifetimes.
GRA

N92-33675# Naval Postgraduate School, Monterey, CA.
CORRELATION OF PROCESSING, MICROSTRUCTURE AND SUPERPLASTICITY IN AN Al-Mg-Zr ALLOY M.S. Thesis
Peter C. Lyle Mar. 1992 74 p
(AD-A252971) Avail: CASI HC A04/MF A01

Investigation of the influence of the strain history during thermomechanical processing of an Al-10Mg-0.1Zr was conducted. Refined, recrystallized microstructures resulted when larger strains were employed in the later passes of the TMP. Superplastic responses up to approximately 420 percent were obtained. Conversely, when smaller strains were used at the later stages of the TMP, less recrystallized, coarser structures resulted, and the corresponding superplastic ductilities of approximately 280 percent were obtained. GRA

N92-33733# Los Alamos National Lab., NM.
CATALYSIS AT EXPERIMENTALLY DESIGNED SURFACES: N-BUTANE HYDROGENOLYSIS AT Sn/GROUP V3 SURFACE ALLOYS
A. D. Logan and M. T. Paffett 1992 5 p Presented at the 10th International Congress on Catalysis, Budapest (Hungary), 19-24 Jul. 1992
(Contract W-7405-eng-36)
(DE92-007424; LA-UR-92-40; CONF-920701-1) Avail: CASI HC A01/MF A01

Bimetallic (radical)3x(radical)3R30 deg -Sn/M(111) (M=Ni, Pt) surface alloys were prepared in an ultrahigh vacuum system and used in model moderate pressure (1-200 Torr) catalytic reactions. Hydrogenolysis of n-butane (H2/n - C4=20) was used to characterize the effects of ordered bimetallic ensembles relative to those available at the respective (111) surfaces. The effect of alloying Sn into the Ni(111) surface produced an overall lowering of the catalytic reactivity nearly equal to the number of Ni surface sites lost upon producing the (radical)3x(radical)3R30 deg surface alloy. In addition, the overall rate of hydrogenolysis of n-butane at the (radical)3x(radical)R30 deg -Sn/Pt(111) surface alloy was also found to have decreased (although not in proportion to the loss of total Pt atoms). Catalytic deactivation due to carbon buildup was observed to decrease significantly at both of the ordered (radical)3x(radical)3R30 deg -Sn/M(111) surface alloys under reaction conditions. DOE

N92-33752# Rolls-Royce Ltd., Derby (England).
HEAT TREATMENT OF A MELT SPUN Fe70Cr18Mo2B10 ALLOY
W. T. Kim (Oxford Univ., England), K. Clay, C. Small, and B. Cantor (Oxford Univ., England) 7 Aug. 1990 15 p Repr. from Journal of Non-Crystalline Solids, v. 127, 1991 p 273-286
(PNR-90877; ETN-92-92187) Copyright Avail: CASI HC A03/MF A01

Microstructural changes during annealing of melt spun Fe70Cr18Mo2B10 ribbons were studied by a combination of differential scanning calorimetry, X-ray diffractometry, transmission electron microscopy, and energy dispersive X-ray microanalysis. The as-melt spun microstructure consists of bcc ferrite primary crystals embedded in an amorphous matrix. The crystallization onset, peak and finish temperatures of the amorphous phase are 533, 552, and 573 C, respectively, during continuous heating at 10 C/min. Isothermal annealing of the as-solidified amorphous ribbons for 2 hours at different temperatures in the range 500 - 1000 C leads to a variety of different microstructures depending on the annealing temperature. At 500 and 600 C, the amorphous alloy crystallizes to form a fine scale mixture of bcc ferrite grains and Cr rich primitive tetragonal M3B boride particles. At 700 and 800 C, the alloy microstructure tranforms into a mixture of faulted Cr rich orthorhombic M2B and Mo rich fcc M23B6 boride particles embedded in a matrix of bcc ferrite. At 900 C, the bcc ferrite matrix is replaced by fcc austenite, which transforms to dislocated lath martensite on cooling to room temperature. At 950 and 1000 C the Mo rich fcc M23B6 boride particles are replaced by Mo rich primitive tetragonal M3B2 boride particles. ESA

N92-33817# Rolls-Royce Ltd., Derby (England).
IN-SITU/SEM FATIGUE STUDIES OF SHORT CRACK BEHAVIOR AT AMBIENT AND ELEVATED TEMPERATURES IN A NICKEL-BASE SUPERALLOY
Robert R. Stephens (Utah Univ., Salt Lake City.), Leon Grabowski, and David W. Hoeppner (Utah Univ., Salt Lake City.) 1 Dec. 1990 25 p Presented at the Short Crack Conference, Sheffield, England, 1990
(PNR-90858; ETN-92-92179) Copyright Avail: CASI HC A03/MF A01

The development of a fatigue in situ Scanning Electron Microscope (SEM), designed to monitor the growth of short cracks on high performance materials at elevated temperatures, is described. Its use is demonstrated with respect to the formation and growth of short cracks in Waspaloy at 25 and 500 C subject to fatigue at R = 0.1. Short crack growth was found to occur at greater rates at 500 C in comparison to 25 C. The difference was attributed to a change in slip mode resulting in a change from highly faceted growth to a more homogeneous growth. ESA

N92-33818# Rolls-Royce Ltd., Derby (England).
FATIGUE OF A NICKEL-BASE SUPERALLOY AT POSITIVE AND NEGATIVE STRESS RATIOS USING AN OPTICAL SYSTEM
J. C. Healy (Birmingham Univ., England), L. Grabowski, and C. J. Beevers (Birmingham Univ., England) 1 Jan. 1991 21 p Presented at the I/National Conference on Short Fatigue Cracks, 10-14 Dec. 1990
(PNR-90859; ETN-92-92180) Copyright Avail: CASI HC A03/MF A01

The development of an optical crack monitoring system designed to monitor the growth of short/long fatigue cracks in Waspaloy at room and elevated temperature is described. Its use at room (19 C) and elevated (500 C) temperature is demonstrated at stress ratios (R) = 0.1 and -1. At 19 C short crack growth at R = -1 and R = 0.1 could not be normalized by adopting a positive stress approach. Short crack growth at 500 C and R = -1 exhibited lower growth rates in comparison to an equivalent long crack trend. ESA

N92-33891# Cornell Univ., Ithaca, NY.
NONLINEAR, DISTORTIVE PHENOMENA IN SOLIDS: MARTENSITIC, CRACK, AND MULTISCALE STRUCTURES
J. A. Krumhansl and J. P. Sethna 1992 6 p
(Contract DE-FG02-88ER-45364)
(DE92-017532; DOE/ER-45364/T2) Avail: CASI HC A02/MF A01

This ongoing program, from the beginning of the first three year grant 1988-1991 and now in the first year of the second phase 1991-1994, has been directed at developing both an understanding of the physics underlying structural transformations in real (alloy) materials as well as new theoretical methods which adequately describe the large (nonlinear) distortions which characterize such processes. We have had a particular interest in martensitic systems, first (1988-1991) in the equilibrium limits, and now (below) in phenomena associated with the transformation process. DOE

N92-33904# Ecole Centrale de Lyon (France).
THE INFLUENCE OF MARTENSITIC TRANSFORMATION AND ORDER-DISORDER FAULT INTERACTIONS ON MECHANICAL HYSTERESIS IN CuZnAlNi SHAPE MEMORY ALLOYS Ph.D. Thesis [INFLUENCE DES INTERACTIONS DES DEFAUTS, DE L'ORDRE-DESORDRE ET DE LA TRANSFORMATION MARTENSITIQUE SUR L'HYSTERESIS MECANIQUE D'UN ALLIAGE A MEMOIRE DE FORME CUZNALNI]
Laurent Buffard 1991 301 p In FRENCH Sponsored by Association Nationale pour la Recherche Technique
(ECL-90-24; ETN-92-91960) Avail: CASI HC A14/MF A03

The use and manufacturing of shape memory alloys as thermomarkers is addressed. Generalities of CuZnAl shape memory alloys are presented. The influence of thermomechanical treatment

on mechanical hysteresis of CuZnAlNi elastic properties is studied. Physical and microstructural characteristics of the alloys and the influences of thermomechanical treatment are analyzed. ESA

N92-33907 National Physical Lab., Teddington (England). Materials Metrology Div.
THE FUTURE OF MTDATA: A REVIEW OF USERS' RESPONSES AND SUGGESTIONS. APPENDIX: A SUMMARY OF USERS' VIEWS ON THE MTDATA DATABANK AND THE MTDATA USERS GROUP
R. H. Davies, J. A. Gisby, and J. R. Taylor (Johnson Matthey Research Centre, Reading, England) Mar. 1992 37 p
(NPL-DMM(A)-60; ETN-92-91987) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

MTDATA is a databank for metallurgical thermochemistry and the calculation of phase equilibria. A discusssion of views expressed by MTDATA users about the databank is presented. Topics covered include its performance, the support available, the MTDATA users group and requests from users for future modifications which they would like to see made. Each request for a new feature is considered in turn and the feasibility, and desirability of making the appropriate change is assessed. A digest of the users' opinions upon which this report is based is presented in an appendix. This was compiled by the chairman of the MTDATA users group from questionnaires completed and returned by existing and potential MTDATA users. ESA

N92-33938# Rensselaer Polytechnic Inst., Troy, NY.
THE EFFECTS OF RADIOLYSIS OF THE CORROSION AND STRESS CORROSION BEHAVIOR OF 316 STAINLESS STEELS
D. J. Duquette and D. Steiner 1992 11 p
(Contract DE-FG02-89ER-52161)
(DE92-015357; DOE/ER-52161/4) Avail: CASI HC A03/MF A01

This program is focused on the corrosion, stress corrosion, and corrosion fatigue behavior of Type 316 stainless steel (316SS) at 50, 90, and 130 C in high-purity water. Irradiated solution tests are performed using high-energy photon radiation. The purpose of this work is to determine the effects of radiolysis products on the environmental stability of 316SS in support of the ITER first wall/shield/blanket design. Preliminary results suggest that irradiation of pure water at 50 C results in a shift in the electrochemical potential of 316SS of approximately 100 mV in the active direction and nearly an order of magnitude increase in the passive current density as compared to non-irradiated conditions. This proposal outlines a three-year program to develop corrosion design criteria for the use of 316SS in an ITER environment. DOE

N92-33951*# Dartmouth Coll., Hanover, NH. School of Engineering.
IMPROVING THE LOW TEMPERATURE DUCTILITY OF NiAl Ph.D. Thesis
Sumit Guha Jul. 1992 289 p
(Grant NAG3-775)
(NASA-CR-189211; NAS 1.26:189211) Avail: CASI HC A13/MF A03

The intermetallic NiAl exhibits excellent potential as a structural material for application in air-breathing and single-stage-to-orbit engines. Unfortunately NiAl is brittle at ambient temperature, which is partly attributed to the lack of five independent slip systems as required by von Mises criterion for uniform, volume conserving deformation since the operative group of zone axes (100) slip offers only three independent slip systems. Isostructural FeAl, however, deforms by group of zone axes (111) slip at room temperature which provides five independent slip systems. Thus, it was decided to macroalloy NiAl with Fe to promote group of zone axes (111) slip thereby possibly improving the ductility. For Ni - 30 at. (percent) Al - 20 at. (percent) Fe having essentially bcc microstructure indicated up to 6 percent tensile elongation combined with high yield strength (about 800 MPa). The results compare favorably with those of stoichiometric Ni - 50 at. (percent) Al which, however, deforms by group of zone axes (100) slip at room temperature. The multi-phase alloy approach has proven even more successful for Ni - 20 at. (percent) Al - 30 at. (percent) Fe. The high temperature ductility of the multi-phase alloy was attributed to deformation transfer across interphase boundaries and the crack stopping action of the constituent gamma/gamma' phase. While the constituent phase became increasingly brittle, the beta' phase became more ductile at elevated temperatures. Thus the multi-phase alloy did not exhibit any elevated temperature embrittlement. Similarly, while the beta' phase became weak at high temperatures, the gamma/gamma' phase exhibited better strength retention leading to the improved elevated temperature strength of the multi-phase alloy. Thus, the multi-phase alloy benefits from both its constituent phases, with each phase alleviating the disadvantages associated with the other phase over any temperature range. The multi-phase alloy approach is suggested as a possible approach to designing intermetallic-based alloys. Author

N92-33985# Arizona State Univ., Tempe. Dept. of Chemistry.
GENERATION, DETECTION AND CHARACTERIZATION OF GAS-PHASE TRANSITION METAL AGGREGATES AND COMPOUNDS
T. C. Steimle 1992 4 p
(Contract DE-FG02-91ER-14227)
(DE92-017868; DOE/ER-14227/1) Avail: CASI HC A01/MF A01

The goal of our research is to employ spectroscopic techniques to characterize the bound portions of the potential energy surface (PES) for chemical systems involving diatomic and triatomic transition metal molecules. The approach incorporates the generation and isolation of new metal compounds via supersonic laser ablation molecular beam techniques. Detection and characterization is achieved using high resolution dye laser induced fluorescence spectroscopy. A major objective is to produce information which can be compared to theoretical predictions and provide guidelines and insight into the development of reaction models. DOE

N92-34019# Rolls-Royce Ltd., Derby (England).
FATIGUE CRACK GROWTH OF SMALL CORNER DEFECTS FROM BLUNT NOTCHES IN AN AEROENGINE ALLOY
I. W. Hussey, J. Byrne (Portsmouth Polytechnic, England), and W. Locke (Aerostructures Hamble, Portsmouth, England) 1 Dec. 1991 22 p
(PNR-90860; ETN-92-92181) Copyright Avail: CASI HC A03/MF A01

The study of the fatigue crack gorwth behavior of physically small cracks within notch elastic stress fields, previously applied to through cracks, is extended to corner cracks. The fatigue growth rate of small corner defects from the bore extremities of blunt keyhole notches (k(sub T) = 1.74 to 2.4) in CT specimens was studied for Waspaloy at room temperature. Variation in crack shape was determined by beach marking to establish an aspect ratio calibration with increasing crack length. Both surface and inferred bore results were compared with an approximate analysis, according to Chell, which determines the stress intensity factor for part-through cracks in regions of varying stress. The experimental results demonstrate that the theoretical predictions based on this analysis provide conservative estimates of the stress intensity factor on the absence of microstructural short crack effects and crack interactions. ESA

N92-34078# Argonne National Lab., IL.
OXIDATION BEHAVIOR OF IRON-CHROMIUM ALLOYS AT ELEVATED TEMPERATURES: A REACTIVE-ELEMENT EFFECT
J. H. Park and K. Natesan Mar. 1992 59 p
(Contract W-31-109-eng-38)
(DE92-017143; ANL/FE-92/1) Avail: CASI HC A04/MF A01

Oxidation tests were conducted on samples of Fe-25Cr, Fe-25Cr-0.3-1.0Y, and Fe-25Cr-1Ce at temperatures of 700 to 1000 C and oxygen partial pressures of 1 to 20 atm for time periods of 19 to 160 h. In some tests, oxidized samples were quenched from test temperature to room temperature in approximately 20

min to examine characteristics of the spallation scales. The results showed that the scales, even though of the same composition, spalled totally when developed on Fe-25Cr alloy, while those on Ce- and Y-containing alloys exhibited good scale adherence and no spallation. After removal of the spalled scales, specimens of Fe-25Cr alloy were reoxidized to gain insight into development and morphology of thermally grown scales and their spallation characteristics. The reoxidized samples formed complex scale layers that had iron oxide phase at the gas side of the interface; the scale layer was adherent and no spallation was noted. Experiments were conducted to evaluate the roles of alloy grain size and grain growth rate in development and spallation of oxide scales. Results showed that excessive alloy grain growth is the primary cause of spallation of thermally grown scales. Additions of reactive elements such as Y and Ce minimize alloy grain growth and thus improve the adhesion of scales to the substrate and virtually eliminate spallation. DOE

N92-34102# Oak Ridge National Lab., TN.
FRACTURE OF IRON ALUMINIDE ALLOYS
D. J. Alexander and V. K. Sikka 1992 11 p Presented at the 6th Annual Fossil Energy Materials Conference, Oak Ridge, TN, 12-14 May 1992
(Contract DE-AC05-84OR-21400)
(DE92-017821; CONF-9205123-11) Avail: CASI HC A03/MF A01

Five heats of iron aluminide alloys have been prepared, and their impact fracture properties compared to FA-129 iron aluminide. The first was a simple ternary alloy of iron, aluminum, and chromium to match the FA-129 composition. The second was similar but with additions of zirconium and carbon. The third alloy had zirconium, carbon, niobium, and molybdenum. Two heats were produced with reduced aluminum contents so that a disordered body-centered cubic structure would be present. The impact properties, microstructures, and fractography of these alloys were compared to FA-129. The ductile-to-brittle transition temperatures of all of the Fe3Al alloys were similar, but the simple ternary alloy had a much higher upper-shelf energy. The reduced aluminum alloys had lower transition temperatures. The microstructures were, in general, coarse and anisotropic. The fracture processes were dominated by second-phase particles. DOE

N92-34117# Israel Atomic Energy Commission, Beersheba. Nuclear Research Center.
SIMULATION OF NEUTRON IRRADIATION DAMAGE IN Al-A5 ALLOY BY ION IMPLANTATION
A. Munitz and K. Cotler Sep. 1991 20 p In HEBREW
(DE92-633554; NRCN-559) Avail: CASI HC A03/MF A01

Ion implantation was used to simulate neutron irradiation damage in Al-A5 alloys. The damage was investigated by scanning electron microscopy. H(+) and He(+) ions were implanted up to a dose of 2 x 10(exp 4) microcurie. It was found that H(+) ions caused the appearacnce of blisters and holes on the surface. The density of the blisters and holes is a function of implanted dose. The He(+) ions caused sputtering of surface via flanking. DOE

N92-34239*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
GRADIENT TEMPERING PROCESS Patent Application
Richard A. Parr, inventor (to NASA) 14 Aug. 1992 11 p
(NASA-Case-MFS-28496-1; NAS 1.71:MFS-28496-1; US-Patent-Appl-SN-929553) Avail: CASI HC A03/MF A01

A process for tempering a product made from a metal alloy that produces varying degrees of toughness throughout a cross section of the product is presented. NASA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

N92-33291# Lawrence Livermore National Lab., CA.
TOUGHENED MODERATE-TEMPERATURE CURE EPOXY STRUCTURAL ADHESIVES
J. D. LeMay and R. E. Lyon Mar. 1992 9 p Presented at the 6th International Symposium on Structural Adhesive Bonding, Morristown, NJ, 4-7 May 1992
(Contract W-7405-eng-48)
(DE92-011962; UCRL-JC-107317; CONF-9205146-1) Avail: CASI HC A02/MF A01

Low-viscosity liquid precursor adhesives that can be cured at moderate temperatures and deliver high static strength and fracture toughness in bonded joints are of interest in a variety of structural joining applications at Lawrence Livermore. We have developed a toughened, structural epoxy adhesive that cures completely at 75 C, and has a fracture toughness, K(sub Ic)(joint) = 1.3 MPa(radical)m, in a 100 micron thick bondline. This adhesive is based on diglycidylether of bisphenol-A (DGEBA) epoxide resin in combination with an amidoamine hardener, and is toughened with an epoxide-functional liquid rubber. This adhesive was developed to join beryllium oxide components, but has proven to be a good general purpose structural adhesive for a variety of high surface energy substrates including metals, metal oxide ceramics, and glasses. The low surface tension of the liquid adhesive, gamma = 31 dynes/cm, ensures that it also will wet and bond most low surface energy solids such as plastics and fiber reinforced polymer composites. DOE

N92-33396# Pennsylvania State Univ., University Park. Materials Research Lab.
MODELING OF SUBSTRATE SURFACE TEMPERATURE DISTRIBUTION DURING HOT FILAMENT ASSISTED DIAMOND DEPOSITION
K. Tankala, T. DebRoy, W. A. Yarbrough, and C. J. Robinson 10 Jul. 1992 31 p
(Contract N00014-92-J-1125)
(AD-A252906; TR-4) Avail: CASI HC A03/MF A01

The importance of substrate temperature in determining the quality, uniformity and growth rate of diamond films is now well recognized. In the hot filament assisted chemical vapor deposition of diamond, the mechanism of heat transfer is unique. In addition to conduction, convection and radiation, filament to substrate heat transfer takes place by dissociation of molecular hydrogen at or near the filament and recombination of atomic hydrogen at the substrate surface. In this paper, the role of atomic hydrogen recombination in heat transfer is examined. Furthermore, the effects of system geometry and process variables on the substrate temperature distribution are analyzed. The results indicate that atomic hydrogen recombination at the substrate plays a significant role in substrate heating. In hot filament assisted diamond deposition, system geometry, filament temperature and pressure are the most important factors in determining the substrate temperature distribution. GRA

N92-33449# California Univ., Berkeley. Lawrence Berkeley Lab.
CERAMIC MICROSTRUCTURES AND THEIR ELUCIDATION BY IMAGING, DIFFRACTION, AND SPECTROSCOPIC METHODS
K. M. Kirshnan Feb. 1992 15 p Presented at the 10th EUREM Conference, Granada (Spain), 7-11 Sep. 1992
(Contract DE-AC03-76SF-00098)
(DE92-014503; LBL-32002; CONF-9209115-1) Avail: CASI HC A03/MF A01

The development and potential utilization of ceramic materials is dependent on a systematic effort involving processing, characterization, and appropriate property measurements. The methods of characterization are numerous and it is important to employ the one that is appropriate to the problem both in terms

of its information content and the achievable level of resolution. With the incorporation of fine probe forming capabilities in a transmission electron microscope and the development of related diffraction, imaging and spectroscopic methods, it is now possible to obtain structural and chemical information from the same region of the sample at high spatial resolution. In this review, recent advances along with representative examples in the application of high resolution electron microscopy (HREM), convergent beam electron diffraction (CBED), low atomic number element microanalysis by x-ray emission spectroscopy (XES), fine structures in electron energy-loss spectroscopy (EELS), and specific site occupancy determination by channeling experiments are discussed. DOE

N92-33475 Research and Productivity Council, Fredericton (New Brunswick).
FRACTOGRAPHY APPLIED TO POLYMERIC MATERIALS. PART 7: EFFECT OF SPECIMEN SIZE, ORIENTATION, AND ANNEALING TREATMENT ON ENVIRONMENTAL CRACKING
P. Chan, J. C. Thornley, and A. B. Mitchell Dec. 1989 59 p
(Contract DREA-W7707-8-0137-01-OSC)
(DREA-CR-90-402-Pt-7; CTN-91-60198) Avail: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

Previous work on environmental cracking revealed that the effect of loading poly methyl methacrylate (PMMA) in methanol was to change the position of crack initiation from the free surface in air to an internal area. The work described here was intended to investigate the environmental cracking mechanism by determining the effect of aspect ratio on creep properties and fracture characterization of PMMA. Parallel tests were carried out in methanol and air to determine the effect of methanol immersion on the cracking mechanism. An observed size effect in the cracking mechanism of PMMA in methanol was attributed to surface softening of the polymer by the methanol. Differences in the creep behavior of PMMA samples in air were related to orientation effects and/or inhomogeneities in the original rolled sheet. Annealing of samples was found to prolong creep ductility of the polymer. CISTI

N92-33477# Jay-Em Ceramics, Brampton (Ontario).
DEVELOPMENT OF FIRE PROTECTIVE COATINGS FOR FIBRE REINFORCED PLASTICS USING PLASMA DEPOSITION TECHNOLOGY Final Report
S. Johar Mar. 1989 37 p
(Contract DREA-W7707-8-0067-01-OSC)
(DREA-CR-89-429; CTN-92-60325) Avail: CASI HC A03/MF A01

This report describes work directed toward the development of plasma spray coatings for glass reinforced plastics (GRP). These coatings were to be used to improve fire protection of GRP materials. The work consisted of applying plasma spray coatings on several substrates of glass reinforced plastics. These substrates were coated with alumina, magnesium zirconate, and zirconia ceramic coatings. Emphasis was placed on the development of coatings technology for GRP panels and to utilize the data thus generated to develop a detailed program to optimize the coatings on selected compositions. Coatings based on alumina, magnesium zirconate, and zirconia were successfully applied to GRP specimens. The thermal barrier coatings applied with plasma spray techniques increased the fire retardancy of GRP compositions by delaying ignition on specimens as shown by ASTM E119 tests. There is a need to optimize the thickness. Some specimens began releasing smoke before the coating process was complete and some coatings flaked off during the coating buildup. The phenolic based GRP materials performed best as in this case ignition takes place only after 55 minutes even for uncoated specimens. Smoke evolution was minimal. Coated phenolic specimens did not ignite even after 60 minutes of heating. Damage to the panel was minimal and the coating remained intact. A brief description of future programs is also given. Author (CISTI)

N92-33497# Missouri Univ., Kansas City.
AN INVESTIGATION CONCERNING THE POTENTIAL FOR USE OF POLYLACTIC/POLYGLYCOLIC ACID CONFLUENT SHEETS IN THE TREATMENT OF OSSEOUS DEFECTS
Charles M. Cobb, Caesar E. Solano, John C. Reed, and Robert W. Hiatt 1992 14 p
(Contract N00014-90-J-4087)
(AD-A252769) Avail: CASI HC A03/MF A01

Polylactic/polyglycolic acid combinations (alpha polyamides) are biodegradable materials commonly used in suture materials and surgical meshes for the temporary support of abdominal organs. The materials are well known in the clinical literature and have been in common usage without risk for over two decades. The polyamides are rich in polyester linkages that are degraded in aqueous environments by hydrolysis. Various investigators have shown that the pure form of polyglycolic acid (PGA) degrades over a period of 5 months whereas pure polylactic acid (PLA) takes about 6.5 months. Copolymers of PLA/PGA have been synthesized that degrade within a few weeks to several months depending upon the ratios employed and the specific sequencing of the chemical units. Further, the alpha polyamides show no adverse host tissue reactions when implanted in numerous animal models. GRA

N92-33520# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
MOLECULAR ENGINEERING OF LIQUID CRYSTALLINE POLYMERS BY LIVING POLYMERIZATION. 23: SYNTHESIS AND CHARACTERIZATION OF AB BLOCK COPOLYMERS
Virgil Percec and Myongsoo Lee 27 Mar. 1992 28 p
(Contract N00014-90-J-1828)
(AD-A248288; TR-62) Avail: CASI HC A03/MF A01

This paper describes the synthesis and characterization of AB block copolymers based on w-((4-cyano-4'-biphenyl)oxy) -alkyl -vinyl ether (6-n) with alkyl being ethyl (6-2), propyl (6-3), nonyl (6-9), and undecanyl (6-11) with 1H, 1H, 2H, 2H-perfluorodecyl vinyl ether (CF8), poly((6-n)-b-CF8)X/Y (where X/Y refers to the weight ratio of the two segments), and of 2-(4-biphenyloxy)ethyl vinyl ether (BEVE) with 1H, 1H, 2H, 2H-perfluoeodecyl vinyl ether, poly(BEVE-b-CF8)X/Y. They were prepared by living cationic polymerization and exhibit a narrow molecular weight distribution. All block copolymers display a microphase separated morphology when the A segment is in the liquid crystalline phase. Block copolymers based on 6-2, 6-3, and BEVE with CF8 exhibit a microphase separated morphology also in the melt phase of A and B block. GRA

N92-33551# Argonne National Lab., IL.
HIGH-TEMPERATURE TRIBOLOGICAL CHARACTERISTICS OF SILVER AND GOLD COATINGS ON CERAMICS PREPARED BY ION-BEAM-ASSISTED DEPOSITION
A. Erdemir, R. A. Erck, G. R. Fenske, and F. A. Nichols Apr. 1992 26 p Presented at the China International Symposium for Youth Tribologists, Lanzhou (China), 10-14 Aug. 1992
(Contract W-31-109-eng-38)
(DE92-016776; ANL/CP-76056; CONF-9208102-1) Avail: CASI HC A03/MF A01

An ion-beam-assisted deposition (IBAD) system was used to deposit silver and gold coatings on polycrystalline (alpha)-alumina (Al2O3) substrates for tribological studies at temperatures to 400 C. The wear tests were performed with an oscillating ball-on-flat type of test apparatus as a partial simulation of ring/liner motion and contact geometry in actual engine systems. The test results showed that without a surface coating, both the wear rates and the friction coefficients of Al2O3/Al2O3 test pairs were quite high, and increased substantially with temperature. In contract, the wear of flats coated with silver and gold was at unmeasurable levels, even after sliding tests of 110,000 passes. The wear of balls (uncoated) sliding against the Ag- and Au-coated flats was reduced by factors of 45 to more than 500 depending on coating type and ambient temperature. The friction coefficients of pairs with an IBAD-Ag or Au coating were in the range of 0.32-0.5. DOE

N92-33617*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
FREE-VOLUME CHARACTERISTICS OF EPOXIES
Jag J. Singh, Abe Eftekhari (Hampton Inst., VA.), William J. Shultz (Minnesota Mining and Mfg. Co., Saint Paul.), and Terry L. St.Clair Sep. 1992 13 p
(RTOP 506-43-11-01)
(NASA-TM-4390; L-17104; NAS 1.15:4390) Avail: CASI HC A03/MF A01

Positron annihilation spectroscopy was used to measure free-volume characteristics of selected epoxies. Fluorene resins, a new family of high-temperature thermosetting resins, were selected as the test medium. Experimental results indicate that the free-volume cell size V sub f varies with the molecular weight between the cross-links M sub c according to an equation of the form V sub f = AM sub c sup B, where A and B are structural constants. In two of the samples, the concentration of bulky fluorene groups was increased in the network backbone by replacement of some of the conventional bisphenol A epoxy resin with fluorene-derived epoxy resin. This resulted in an increase in their glass transition temperature for a given level of cross-linking. It was found that in these samples, the Doppler broadening of the annihilation peak decreases with the increasing fluorene content, presumably due to enhanced damping of the chain motions. Author

N92-33633 Department of the Navy, Washington, DC.
CORROSION-RESISTANT ACRYLIC COATINGS Patent
Charles R. Hegedus, inventor (to Navy), Donald J. Hirst, inventor (to Navy), William J. Green, inventor (to Navy), and Anthony T. Eng, inventor (to Navy) 31 Mar. 1992 5 p Filed 3 Apr. 1991
(AD-D015327; US-Patent-5,100,942; US-Patent-Appl-SN-682154; US-Patent-Class-524-204) Avail: US Patent and Trademark Office

This invention relates to a corrosion-resistant coating capable of being applied to various substrates, e.g., particularly metal and plastic surfaces, as a single coat characterized as having a high-gloss, good adhesion, and a high degree of flexibility. The corrosion inhibiting composition comprises an acrylic resin containing an effective amount of a corrosion-inhibiting pigment system consisting essentially of critical amounts of at least one zinc phosphate, zinc molybdate, and at least one zinc salt of a benzoic acid. GRA

N92-33635*# Battelle Columbus Labs., OH.
LUBRICANT EVALUATION OF THE ALPHA AND BETA JOINTS, PHASE 2 Final Report
J. W. Kannel and R. D. Stockwell 12 Feb. 1992 66 p Original contains color illustrations
(Contract NAS8-36655)
(NASA-CR-184364; NAS 1.26:184364) Avail: CASI HC A04/MF A01; 1 functional color page

A research study was conducted to evaluate dry film lubrication of long life space components such as the alpha and beta joints of the Space Station. The problem addressed in the report pertains to the longevity of sputtered MoS2 or ion plated lead films in a rolling contact environment. A special technique was devised for the experiments, which incorporated a coated ball cyclically loaded against a flat plate. At fixed intervals the surface of the coating was photographed at 100X magnification. By computer scanning the photographs, the rate of coating loss was determined. Experimental variables include load and surface finish of the plate. A theory was developed to analyze the state of stress between ball and flat. The stress condition in the ball apparatus was related to the state of stress under rolling contact conditions. Based on the experiments life appeared to decrease with increasing load and increasing surface roughness. An ion plated lead film gave better life than a sputtered MoS2 film. However, by keeping the interfacial shear stress at a low level, adequate coating life was achieved for either coating. For the lead film, the critical stress was about 0.19 GPa (28 ksi). The study dealt only with mechanical wear. Before a coating is selected for a critical space application, other factors such as reaction with atomic oxygen must also be considered. Author

N92-33636*# Battelle Columbus Labs., OH.
LUBRICANT SELECTION MANUAL, PHASE 3
J. W. Kannel, J. A. Lowry, and K. F. Dufrane 22 Nov. 1991 44 p
(Contract NAS8-36655)
(NASA-CR-184363; NAS 1.26:184363) Avail: CASI HC A03/MF A01

Future spacecraft must be designated to operate for very long time periods in space. For example, a target goal for the Space Station is 30 years of operation. Although the actual life may be significantly less than this optimistic goal, the life will certainly be a critical issue in design. The bearings on primary components such as the alpha and beta joints must obviously be designed and lubricated with the objective of optimum performance life. In addition to these joints, there will be numerous other tribological (rubbing or rolling) interfaced that will be required to function for the life of the spacecraft. A major key to adequate performance of tribological interface is proper lubrication. Lubricants can be divided into two basic classes: solid films and liquids. Both types have been used extensively in space applications. Both have advantages and disadvantages that must be carefully considered in their selection. The purpose here is to summarize selection criteria for liquid and solid lubricants applied to long-life spacecraft. Author

N92-33649# National Research Council of Canada, Boucherville (Quebec). Industrial Materials Inst.
MEASUREMENT OF DIFFUSIVITY BY THE FLASH METHOD OF PLASMA TORCH SPRAYED TUNGSTEN COATINGS [MESURE DE DIFFUSIVITE PAR LA METHODE FLASH DE REVETEMENTS DE TUNGSTENE PROJETES PAR TORCHE PLASMA]
Philippe Fargier-Richard 23 Jul. 1992 51 p In FRENCH
(NRC-33744; IMI-92RT-23600-1302-G; CTN-92-60575) Avail: CASI HC A04/MF A01

The principles of plasma arc spraying are described along with the buildup and microstructure of plasma sprayed deposits. Factors affecting the adhesion and structure of these deposits are assessed, and some applications of plasma sprayed coatings in aeronautics and mechanics are outlined. Results are presented from experimental work conducted to study the parameters involved in plasma arc spraying under different conditions, to determine the thermal diffusivity of the coatings by the flash method, and to study the influence of spray parameters on the values of these diffusivities. The flash method consists of producing a short-duration heat impulse on one face of a sample and observing the temperature history of the other face. In the spraying of tungsten deposits on copper substrates, an analysis of variance indicates that the most important factor influencing thermal diffusivity is the spray atmosphere, followed by the speed of displacement of the plasma torch, and the flow of tungsten powder. The diffusivity of the sprayed tungsten coatings was found to be 7 to 22 times less than for solid tungsten. Coatings deposited in argon atmospheres were denser and had higher diffusivities than those deposited in air. CISTI

N92-33662 National Physical Lab., Teddington (England). Materials Metrology Div.
SELECTION OF EQUATIONS FOR ELASTIC MODULUS MEASUREMENT OF ADVANCED TECHNICAL CERAMICS USING RESONANT AND IMPULSE EXCITATION METHODS
R. Morrell Mar. 1992 13 p
(NPL-DMM(A)-62; ETN-92-91989) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

In order to define appropriate equations for elastic modulus measurement by resonant and impulse excitation methods for inclusion in new CEN standard test methods for elastic properties, the errors involved in simplifying existing equations and correction factors are examined as a function of specimen shape. They are

compared with potential errors of measurement of mass and dimensions. Recommendations to be incorporated in the CEN standard draft are justified. ESA

N92-33684# Sandia National Labs., Livermore, CA.
TEMPERATURE PROGRAMMED DESORPTION OF HYDROGEN AND DEUTERIUM FROM CVD DIAMOND SAMPLES
M. T. Schulberg, G. D. Kubiak, and R. H. Stulen 1992 8 p Presented at the Material Research Society Spring Meeting, San Francisco, CA, 27 Apr. - 2 May 1992
(Contract DE-AC04-76DR-00789)
(DE92-016633; SAND-92-8537C; CONF-920402-37) Avail: CASI HC A02/MF A01

The desorption kinetics of H2, HD, and D2 from a CVD-grown diamond sample have been measured using temperature programmed desorption. The sample was exposed to hydrogen and deuterium at approximately 100 K. Molecular hydrogen does not react with the diamond surface but atomic hydrogen chemisorbs. The sample is then heated to 1500 K at a rate of 6 K/s. The hydrogen desorption spectrum from these polycrystalline specimens is surprisingly simple, consisting of a single peak near 1270 K for all coverages studied. The width of the desorption peak is approximately 100 K. Neither the width nor the peak maximum shift with increasing hydrogen coverage. There is no isotope effect to the desorption. No other desorption products (water, small hydrocarbons) are detected. Kinetic parameters can be extracted from these spectra, and these can be compared to hydrogen desorption from natural diamond single crystal surfaces. These parameters can be used to model diamond growth processes. DOE

N92-33716# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
STUDY OF THE EFFECT OF ABSORBED WATER ON THE Tg OF A POLY(AMIDEIMIDE)
John A. Hiltz and Irvin A. Keough Dec. 1991 29 p
(DREA-91-215; CTN-92-60573) Avail: CASI HC A03/MF A01

Poly(amideimide)s (PAI's) are characterized by high thermal stability, inherent flame resistance, good stress rupture resistance, and excellent dimensional stability and strength over an extended temperature range. As a result, PAI's are used in high temperature electrical connectors, electronic, and aerospace applications, as well as a replacement for metallic materials in certain parts of internal combustion engines. However, PAI's absorb water when exposed to the environment; this is of concern since water acts as a plasticizer and affects the glass transition temperature (T(sub g)) of the polymer. The dependence of T(sub g) on the weight percent of absorbed water was investigated using differential scanning calorimetry (DSC) and dynamic mechanical analysis (DMA) for a commercial PAI, Torlon 4203. The Tg of this PAI as determined from DMA was found to decrease monotonically from 295 to 204 C as the water absorbed increased from 0 to 4.25 percent. The DSC results indicated that the diffusion of water from the sample had a major effect on correlations between T(sub g) and percent of absorbed water. Diffusion studies showed that the activation energy for the absorption of water into Torlon 4203 was 44.2 kJ/mole and the permeability index was 0.0000117 sq m/s. The effect of absorbed water on the dimensional stability of Torlon 4203 samples heated rapidly to temperatures in the vicinity of T(sub g) is also discussed. CISTI

N92-33906 National Physical Lab., Teddington (England). Materials Metrology Div.
DELAYED FAILURE/SUBCRITICAL CRACK GROWTH OF CERAMICS
M. J. Reece and J. M. Cox Feb. 1992 68 p
(NPL-DMM(A)-49; ETN-92-91986) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

The theory and practice of studying and measuring subcritical crack growth behavior in ceramic materials are reviewed. The relative merits of the different test methods are discussed, and the errors and scatter in the data generated in these experiments are quantified. The conclusions give guidance on good practice when performing static and dynamic fatigue experiments and highlight areas for future investigations relevant to developing standardized test procedures. ESA

N92-33922# Rice Univ., Houston, TX. Dept. of Chemistry.
THEORETICAL STUDIES OF CLEAN AND HYDROGENATED DIAMOND (100) BY MOLECULAR MECHANICS
Yuemei L. Yang and Mark P. DEvelyn 29 May 1992 18 p
(Contract N00014-91-J-1550)
(AD-A252871; TR-5) Avail: CASI HC A03/MF A01

The atomic structure and energetics of the clean (100)-(2x1), (100)-(2x1):H monohydride, (100)-(1x1):2H full dihydride, (100)-(3x1):1.33H intermediate dihydride, and other intermediate hydride surfaces obtained by local removal of H atoms from or addition of H atoms to the (2x1) monohydride, are investigated by molecular mechanics (MM3). The monohydride phase is found to be the most stable thermodynamically and is predicted to be the dominant phase under chemical vapor deposition conditions. Gas-surface reactions relevant to diamond chemical vapor deposition involving hydrogen and the diamond (100)-(2x1):H surface are discussed in light of the derived energetics. GRA

N92-33964# Los Alamos National Lab., NM.
A MODEL FOR THE FILLING OF COLD CAVITIES WITH SOLIDIFYING SEMI-CRYSTALLINE POLYMERS
T. D. Papathanasiou 1992 4 p Presented at the 11th International Congress of Rheology, Brussels, Belgium, 17-21 Aug. 1992
(Contract W-7405-eng-36)
(DE92-008489; LA-UR-92-601; CONF-920852-2) Avail: CASI HC A01/MF A01

This article presents a model for the filling stage of injection molding that includes wall solidification and the development of crystallinity in the solidified polymer skin. The model considers a two dimensional flow analysis, a three dimensional stress analysis based on the White-Metzner constitutive model and a three dimensional thermal analysis. Solution of the model equations is sought numerically, using body fitted curvilinear coordinates (BFCCs) for the discretization of the flow field. The potential of geometry-adaptive BFCCs for the modeling of the filling of complex cavities with or without inserts has been demonstrated in the past. In this work the filling of the simple rectangular cavity is presented, since this geometry facilitates the comparison with analytical solutions as well as the interpretation of the results. The model further considers temperature and pressure dependent material properties. DOE

N92-34136# Department of the Navy, Washington, DC.
HIGH TEMPERATURE ADHESIVE Patent Application
Teddy M. Keller, inventor (to Navy) and Charles M. Roland, inventor (to Navy) 26 Feb. 1992 22 p
(AD-D015286; US-Patent-Appl-SN-841945) Avail: CASI HC A03/MF A01

A substrate assembly and method for its preparation comprising at least two substrates adhesively bonded with a cured thermosetting polymer that is able to withstand a temperature of 200-400 C is presented. The polymer is derived from a diphthalonitrile monomer and/or prepolymer with an aromatic moiety in the bridging group. The monomer and/or prepolymer is solid at room temperature but is rendered liquid by heating it above its melting temperature. The monomer in liquid state, and its prepolymer in liquid state, have tack with respect to the substrate. GRA

N92-34160* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
BORON-CARBON-SILICON POLYMERS AND CERAMIC AND A PROCESS FOR THE PRODUCTION THEREOF Patent
Salvatore Riccitiello, inventor (to NASA), Ming-Ta Hsu, inventor (to NASA), and Timothy S. Chen, inventor (to NASA) 14 Jul. 1992 8 p Filed 18 Jan. 1991 Division of US-Patent-Appl-SN-361471, filed 5 Jun. 1989
(NASA-Case-ARC-11891-2-SB; US-Patent-5,130,278;

US-Patent-Appl-SN-643629; US-Patent-Appl-SN-361471;
US-Patent-Class-501-92; US-Patent-Class-501-93;
US-Patent-Class-501-96; US-Patent-Class-501-97;
Int-Patent-Class-C04B-35/56) Avail: US Patent and Trademark Office

The present invention relates to a process for the production of an organoborosilicon preceramic polymer. The polymer is prepared by the reaction of vinylsilane or vinlymethylsilanes (acetylene)silane or acetylene alkyl silanes and borane or borane derivatives. The prepolymer form is pyrolyzed to produce a ceramic article useful in high temperature (e.g., aerospace) or extreme environmental applications.

Official Gazette of the U.S. Patent and Trademark Office

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N92-33426# Argonne National Lab., IL. Energy Systems Div.
EXPERIMENTAL EVALUATION OF OXYGEN-ENRICHED AIR AND EMULSIFIED FUELS IN A SINGLE-CYLINDER DIESEL ENGINE, VOLUME 2
R. R. Sekar, W. W. Marr, R. L. Cole, and T. J. Marciniak Nov. 1991 255 p
(Contract W-31-109-eng-38)
(DE92-015651; ANL/ESD/TM-30-Vol-2) Avail: CASI HC A12/MF A03

This report contains the data gathered from tests conducted on a single-cylinder diesel engine to study the benefits and problems of oxygen-enriched diesel combustion and the use of water-emulsified and low-grade diesel fuels. This research, funded by the Office of Industrial Technologies (OIT) in the United States Department of Energy, is being conducted in support of the Industrial Cogeneration Program. The report is made up of two volumes. Volume 1 contains the description of the experiments, selected data points, discussion of trends, and conclusions and recommendations; volume 2 contains the data sets. With the two-volume approach, readers can find information at the desired level of detail, depending on individual interest or need. DOE

N92-33567*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
IGNITION AND COMBUSTION CHARACTERISTICS OF METALLIZED PROPELLANTS Annual Report, Jul. 1991- Jul. 1992
D. C. Mueller and Stephen R. Turns Jul. 1992 53 p
(Grant NAG3-1044)
(NASA-CR-190613; NAS 1.26:190613; PSU-TR-92-010) Avail: CASI HC A04/MF A01

During this reporting period, theoretical work on the secondary atomization process was continued and the experimental apparatus was improved. A one-dimensional model of a rocket combustor, incorporating multiple droplet size classes, slurry combustion, secondary atomization, radiation heat transfer, and two-phase slip between slurry droplets and the gas flow was derived and a computer code was written to implement this model. The STANJAN chemical equilibrium solver was coupled with this code to yield gas temperature, density, and composition as functions of axial location. Preliminary results indicate that the model is performing correctly, given current model assumptions. Radiation heat transfer in the combustion chamber is treated as an optically-thick participating media problem requiring a solution of the radiative transfer equation. A cylindrical P sub 1 approximation was employed to yield an analytical expression for chamber-wall heat flux at each axial location. The code exercised to determine the effects of secondary atomization intensity, defined as the number of secondary drops produced per initial drop, on chamber burnout distance and final Al2O3 agglomerate diameter. These results indicate that only weak secondary atomization is required to significantly reduce these two parameters. Stronger atomization intensities were found to yield decreasing marginal benefits. The experimental apparatus was improved to reduce building vibration effects on the optical system alignment. This was accomplished by mounting the burner and the transmitting/receiving optics on a single frame supported by vibration-isolation legs. Calibration and shakedown tests indicate that vibration problems were eliminated and that the system is performing correctly. Author

N92-33672# Ballistic Research Labs., Aberdeen Proving Ground, MD.
PRESSURE OSCILLATIONS IN A LIQUID PROPELLANT GUN: POSSIBLE DEPENDENCE ON PROPELLANT BURNING RATE Final Report, Feb. 1991 - Jan. 1992
Nathan Klein, Terrence P. Coffee, and Charles S. Leveritt Jun. 1992 30 p
(AD-A252758; BRL-TR-3361) Avail: CASI HC A03/MF A01

High frequency pressure oscillations have been observed in liquid propellant gun firing records, and modeling of the combustion process indicates that the oscillations are affected by the burning rate of the propellant. The HAN-based propellants have consisted of stoichiometric, aqueous mixtures of the nitrate salts of hydroxylamine (HAN) and an aliphatic amine (AAN). These mixtures decompose sequentially because HAN is less stable thermally than is the AAN. Combustion is obtained when the products of the HAN decomposition react with the molten AAN droplets. The nitrate salts of tertiary amines result in the smoothest and most rapid combustion, and thus triethanolammonium nitrate (TEAN) is the AAN salt used in the propellants LGP1845 and LGP1846. Attempting to further raise the burning rate of the propellant mixtures requires circumventing the sequential nature of the reactions. Decomposition of hydroxylamine in which alkyl groups have replaced hydrogen should be essentially concomitant with HAN but reactive organic fragments will be available sooner and such mixtures should burn faster. Using the nitrate salt of N,N-diethylhydroxylamine (DEHAN), a mixture containing 20 percent water was prepared. This propellant burns 17 times faster than LGPl846 and the combustion model indicates that the HAN-DEHAN mixture should essentially eliminate the observed pressure oscillations. GRA

N92-34053# Sandia National Labs., Albuquerque, NM.
MODELING LOW ENERGY LASER IGNITION OF EXPLOSIVE AND PYROTECHNIC POWDERS
M. W. Glass, J. A. Merson, and F. J. Salas 1992 14 p Presented at the 18th International Pyrotechnics Seminar, Breckenridge, CO, 13-17 Jul. 1992
(Contract DE-AC04-76DP-00789)
(DE92-015000; SAND-92-0249C; CONF-920796-4) Avail: CASI HC A03/MF A01

Laser diode ignition (LDI) of explosives and pyrotechnics is being developed at Sandia National Laboratories as a replacement for low energy hotwire devices. This technology offers significant improvements in device safety due to the insensitivity to electrostatic discharge (ESD) and electromagnetic radiation (EMR). The LDI system incorporates a laser diode source, a fiber optic cable to transmit the laser energy, and the energetic component. The laser energy is volumetrically absorbed by the explosive component causing its temperature to rise to its auto-ignition temperature. Substantial experimental work characterizing the optical ignition mechanism has been undertaken in support of the LDI development work. This work was primarily focused on the explosive component, CP, 2-(5-cyanotetrazolato) pentaammminecobalt(3) perchlorate, doped with a small amount of carbon black to enhance the laser energy absorptance at the 850 nm wavelength of the laser diode. To support the experimental efforts, numerical modeling of the thermal response of CP to a low energy laser input was undertaken. DOE

N92-33343*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
BENEFITS AND TECHNOLOGY READINESS FOR USING CRYOGENIC INSTEAD OF STORABLE PROPELLANTS FOR RETURN MISSION FROM MOON
David W. Plachta *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 522-539 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology.*

N92-33505# European Space Agency, Paris (France).
SOUNDING ROCKET EXPERIMENTS IN FLUID SCIENCE AND MATERIALS SCIENCES: TEXUS 21 TO 24 AND MASER 3 Final Reports
Brigitte Kaldeich, ed. Mar. 1992 147 p Original contains color illustrations
(ESA-SP-1132-Vol-2; ISBN-92-9092-104-08; ETN-92-91972)
Copyright Avail: CASI HC A07/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

A compilation of the complete final reports by the investigators in the experiments carried out in 1989 aboard TEXUS (German acronym for technological experiments under weightlessness) 21 to 24 and MASER (Materials Science Experiment Rocket) 3 is presented. A complete list of all of the fluid and materials science experiments which were flown is given. However, only the results of successful experiments are reported. With TEXUS and MASER, payloads of about 250 kg are flown up to an apogee of around 300 km, thus providing experiment times of up to 7 minutes with residual accelerations of less than 0.0001 g. From sounding rocket flights, experiments are accommodated in dedicated modules which can be easily adapted to any of the three launchers. For individual titles, see N92-33506 through N92-33518.

N92-33506# Escuela Tecnica Superior de Ingenieros Industriales, Madrid (Spain). Lab. de Aerodinamica.
ROTATIONAL INSTABILITY OF A LONG LIQUID COLUMN
A. Sanz, J. M. Perales, and D. Rivas *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 8-21 (For primary document see N92-33505 24-29)
(Contract CICYT-ESP-88-0359)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

An experiment in microgravity conditions (TEXUS 23) was performed in order to obtain C-mode deformations of the stability limit (not achieved up to now in a reproducible way). Experiments on Earth using the plateau tank technique were performed in order to obtain more insight into the problem and to prepare experiments aboard sounding rockets. Results of the experiment aboard TEXUS 23 show a reasonably good agreement with the theoretical predictions. ESA

N92-33507# Giessen Univ. (Germany, F.R.). Inst. fuer Physik.
EXPERIMENTS ON MARANGONI-BENARD INSTABILITY PROBLEMS UNDER NORMAL AND MICROGRAVITY CONDITIONS
D. Schwabe, O. Dupont (Vrije Univ., Brussels, Belgium), P. Queeckers (Vrije Univ., Brussels, Belgium), and J. C. Legros (Vrije Univ., Brussels, Belgium) *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 23-35 Presented at the 7th European Symposium on Materials and Fluid Sciences in Microgravity, Oxford, England, 10-15 Sep. 1989 (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Experiments of 5.0 mm thick liquid layers of silicone oil (50 and 150 cSt) under 5.0 mm thick He-gas-gap heated from below to exhibit the Marangoni-Benard instability are described. The dimensions and heating rates are chosen such that it is possible to establish convection in the 360 s microgravity time provided by a TEXUS flight to measure the critical point and to observe the convective pattern. In TEXUS 21, a liquid layer confined by rectangular sidewalls was investigated which exhibits strong sidewall effects and also a circular layer where the side wall effects were minimized by a special construction called 'liquid sidewall'. One-g reference experiments which serve as a basis for the evaluation of the nonquasisteady nature of the time limited microgravity experiment and preliminary microgravity results are reported. ESA

N92-33508# Vrije Univ., Brussels (Belgium). Lab. de Chimie-Physique.
BENARD-MARANGONI INSTABILITY IN A RECTANGULAR CELL
O. Dupont, M. Hennenberg, and J. C. Legros *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 36-48 Submitted for publication (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The results of the Marangoni-Benard instability experiment under microgravity conditions realized in a sounding rocket are given. Due to the short microgravity period allowed to observe the onset of convection, the system was heated very quickly creating a nonuniform temperature gradient in the liquid. This experiment reports the transient behavior of the system and the linear stability analysis is given for such a nonlinear temperature profile. ESA

N92-33509# Naples Univ. (Italy).
ONSET OF OSCILLATORY MARANGONI FLOW: SCIENTIFIC RESULTS OF THE EXPERIMENT PERFORMED IN TELESCIENCE ON TEXUS 23
R. Monti, R. Fortezza, and G. Desiderio *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 49-64 Sponsored by Italian Space Agency and ESA Original contains color illustrations (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The Teletexus experiment performed on TEXUS 23, aimed at the study of Marangoni convection during the phases of transition between axisymmetric to oscillatory motion, is described. The onset of the oscillation regime depends on several parameters: geometry, sample physical and thermodynamic parameters, and boundary conditions. The measurement of the thermo/fluid dynamic conditions in which the convective Marangoni flow in liquid bridge configuration changes and the evaluation of the characteristic numbers give insight into the mechanism driving the phenomena. Research in this field tries to find a 'critical parameter' capable of predicting the transition between the axisymmetric motion and the oscillatory one; up to now, no clear indication exists, even though several attempts have been made by different investigators. This Teletexus experiment was designed to observe, during the six minutes of microgravity time available, the maximum possible number of transitions to oscillations, measuring as many physical parameters as possible. The telescience operation mode was successfully implemented in order to maximize the scientific return. Four oscillation onsets were obtained at different temperature ramps. The experimental results are discussed and compared with numerical simulations. ESA

N92-33510# Essen Univ. (Germany, F.R.). Fachbereich Mechanik.
ON THE THERMOCAPILLARY MOTION OF DROPLETS UNDER REDUCED GRAVITY
Guenter Wozniak *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 65-77 Presented at the 4th Asian Congress

of Fluid Mechanics, Hong Kong, 21-25 Aug. 1989 Sponsored by BMFT (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Surface tension driven motion of liquid droplets in a liquid matrix possessing a temperature gradient is demonstrated in a near gravity-free environment. The experiment was performed in a sounding rocket that provided approximately seven minutes of reduced gravity. It is shown that the droplet velocity increases with the droplet size as was suggested by an earlier linearized analysis. The results are discussed in view of a numerical model, which takes the nonlinear terms of the governing equations into account. For the case of creeping flow and negligible convective heat transport, i.e., for vanishing Reynolds and Peclet numbers, the numerical model was confirmed. Comparison between theory and experiment indicated that the predicted droplet speed values are too high. Possible tentative reasons for this discrepancy are discussed. ESA

N92-33511# Technische Univ., Eindhoven (Netherlands). Colloid Chemistry and Thermodynamics Lab.
COLLOID CHEMISTRY
L. L. M. Krutzer, A. J. G. vanDiemen, and H. N. Stein *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 78-86 (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Mirogravity coagulation experiments (TEXUS 23) to understand the influence of inertia forces, carried out at low shear rates, and where the dispersed particles must have a density difference with the continuous phase, are described. The dispersion was a 0.015 percent quartz in a 0.5 M NaCl solution. The results were unexpected but confirmed the results of the TEXUS 17 experiments: the transmission increases faster under microgravity than under 1 g conditions; and the form of the transmission versus time curves is different under microgravity conditions from the form of these curves under 1 g conditions. The results can neither be explained by the interplay of Brownian and gravity induced coagulation nor by the presence of residual motion, but they seem to point at some exponentially decaying process. ESA

N92-33512# Space Technology Corp., Tokyo (Japan).
DETERMINING THE THERMAL CONDUCTIVITY OF MOLTEN InSb
T. Hibiya, F. Yamamoto, S. Nakamura, and T. Yokota *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 88-91 (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Precise measurement of thermal conductivity of molten semiconductors was undertaken under microgravity conditions using the TEXUS rocket. For measurement purposes the time controlled wire method was chosen. The measurement principle and apparatus are described. An increase in the temperature of the wire as measured on Earth and also under microgravity conditions was observed. There was shown to be a linear relationship between the temperature rise and the logarithm of time under microgravity conditions. On Earth in contrast, deviation from the linear relationship was observed. The thermal conductivity of molten InSb under microgravity conditions is almost constant: 15.8 W/m-K (at 830 K) and 18.2 W/m-K (at 890 K). On Earth the thermal conductivity values appears to increase with time. The measurement of thermal conductivity shows that under microgravity conditions the thermal conductivity of molten semiconductors can be precisely determined. ESA

N92-33513# Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Inorganic Chemistry.
PROTEIN CRYSTALS GROWN ON BOARD MASER 3 EXTEND THE RIBONUCLEASE A STRUCTURE TO 1.06 A RESOLUTION
Lennart Sjolin, Alexander Wlodawer (National Cancer Inst., Frederick, MD.), G. Bergqvist (Swedish Space Corp., Solna.), P. Holm (Swedish Space Corp., Solna.), K. Loth (Swedish Space Corp., Solna.), H. Malmstrom (Swedish Space Corp., Solna.), J. Zaar (Swedish Space Corp., Solna.), L. Anders Svensson (National Inst. of Standards and Technology, Rockville, MD.), Jonathan Dill (National Inst. of Standards and Technology, Rockville, MD.), and Gary L. Gilliland (National Inst. of Standards and Technology, Rockville, MD.) *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 92-103 Sponsored by ESA and Swedish Delegation for Space Research Original contains color illustrations (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

An investigation of microgravity relevance in protein crystal growth is reported. Two proteins were studied in a space flown module and a ground reference unit: Bovine Pancreatic Trypsin Inhibitor (PBTI) and Ribonuclease A (RNase A). The primary analysis of the crystallization chambers, performed shortly after reentry, revealed that more and larger crystals were grown in the launched equipment compared to the crystals grown in the ground reference units. A three dimensional X-ray data set was collected to 1.0 A resolution for the space grown RNase A crystals and the structure was determined. Unlike the earlier 1.26 A structure, phosphate is present in the active site in the space grown crystals. In addition, the higher resolution enabled the modeling of 28 residues with two discrete conformations, 15 more residues than found in the earlier study. ESA

N92-33514# Freiburg Univ. (Germany, F.R.). Inst. fuer Kristallographie.
FLOATING-ZONE GROWTH OF SILICON WITH A PARTIALLY FREE MELT SURFACE
A. Croell, W. Mueller-Sebert, and K. W. Benz *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 104-116 Sponsored by BMFT (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Previous silicon floating zone experiments under microgravity showed that the gravity independent, thermocapillary (Marangoni) convection and not buoyancy convection is responsible for the formation of dopant striations in silicon crystals. By employing partially confined melt zones with only small free surfaces, it was possible to evaluate the critical Marangoni number Ma(c2) for the transition from steady to time dependent convection, to be in the order of 100. A silicon floating zone experiment with partially confined melt surface, performed on the sounding rocket flight TEXUS 22, proved that the effect of time dependent Marangoni convection is not restricted to regions near the melt surface but also has a considerable impact on the bulk volume of the melt. No detectable influence of the steady buoyancy convection present under 1 g on Ma(c2) were found. The comparison of the microgravity and the 1 g crystal showed smaller fluctuations of the dopant concentration in the striated parts of the microgravity crystal as well as different axial and radial macroscopic segregation. These differences can be attributed to reduced mixing of the melt under microgravity due to the absence of buoyancy convection. ESA

N92-33515# Erlangen-Nuremberg Univ. (Germany, F.R.). Inst. fuer Werkstoffwissenschaften.
GROWTH OF GaAs CRYSTALS BY THE FLOATING ZONE TECHNIQUE UNDER MICROGRAVITY
R. Rupp and G. Mueller *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 117-124 (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

TEXUS experiments with the main purpose of preparing the GaAs FZ (Floating Zone) experiments to be carried out during the next German Spacelab mission D2 scheduled for 1992 are

described. It is a main task of these Spacelab experiments to answer the question as to how the homogeneity of the GaAs crystals grown by FZ technique is influenced by the Maragoni convection and which precautions could be taken to stabilize the Marangoni flow. For that purpose doped GaAs crystals with a diameter of 20 mm (this is the minimum limit of technical relevance) were grown under a controlled As vapor pressure with the FZ technique. ESA

N92-33516# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Casting of Metals.
ON THE BEHAVIOUR OF TiC PARTICLES IN THE Al-RICH CORNER OF THE Al-Ti-C PHASE DIAGRAM
A. Jarfors and H. Fredriksson *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 125-137 Sponsored by Swedish Board for Space Activities (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A03/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

Dissolution and precipitation of carbides in the Al-Ti-C system were studied in both microgravity and normal gravity environments, and a theoretical analysis of the reaction was made. In the experiments, stochiometric TiC was added to pure Al and to an Al alloy containing traces of Ti. In pure Al, the TiC reacted at high temperatures to form Al4C3. When Ti was added, the Al4C3 formed at high temperature decomposed during the cooling to reform TiC at low temperature. ESA

N92-33517# Aachener Centrum fuer Erstarrung unter Schwerelosigkeit e.V. (Germany, F.R.).
PARTICLES AGGLOMERATION
M. Mathes and G. J. Schmitz *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 138-143 Original contains color illustrations (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

The experiment SPASS was flown within the MASER 3 mission with the scientific objective to investigate the stability of a dispersion under nonconvective conditions. The aims of these investigations are predictions about the maximum particle density achievable in view of the future production of composite materials in space. A stable dispersion is given for the succinonitrile/Latex system for particle distances down to 1 particle diameter under microgravity conditions without convection. A prerequisite is the absence of external disturbances. Further experiments with different matrix particle systems should be performed to enlarge the data base. The first SPASS experiment was performed successfully, proving the experiment technique works as planned. ESA

N92-33518# Katholieke Univ. te Leuven (Belgium). Dept. Metaalkunde und Toegepaste Materiaalkunde.
LIQUID PHASE PROCESSING OF OXIDE DISPERSION STRENGTHENED ALUMINIUM ALLOYS
L. Froyen, S. DeBondt, and A. Deruyttere *In* ESA, Sounding Rocket Experiments in Fluid Science and Materials Sciences: TEXUS 21 to 24 and MASER 3 Mar. 1992 p 144-149 (For primary document see N92-33505 24-29)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

An experiment to identify if dispersion strengthened aluminum alloys can retain a homogeneous dispersion of submicron alumina particles after a melting and solidification treatment under reduced gravity levels (0.001 g) during a sounding rocket flight is reported. Preparatory ground experiments were performed in a test furnace which is identical to the flight furnace. The thermal gradient during these experiments was such that natural convection was avoided. Two oxide dispersion strengthened aluminum alloys were successfully processed under microgravity conditions. The crucible and furnace setup applied offered the following characteristics: controlled thermal gradient; accurate registration of the thermal history of the sample; good heat transfer; no chemical interactions between sample and crucible. The uniformity of the oxide particles dispersion is slightly better after space processing than after processing on Earth. There is no significant influence of the cooling rate in the final particle distribution. The acting mechanisms for the redistribution of the dispersed oxides are probably Brownian motion and Ostwald ripening. ESA

N92-33461# European Space Agency, Paris (France).
MICROGRAVITY RESEARCH: OUTLOOK AND PLANS
G. Seibert *In its* Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 27-32 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

N92-33463# Commissariat a l'Energie Atomique, Grenoble (France). Section d'Etudes de la Solidification et de la Cristallogenese.
MATERIALS SCIENCE AND TELESCIENCE [SCIENCE DES MATERIAUX ET TELESCIENCE]
J. P. Praizey and J. J. Favier *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 45-48 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

N92-33866*# National Aeronautics and Space Administration, Washington, DC.
THE SPACELAB LIFE SCIENCES 1 SHUTTLE MISSION
Robert W. Phillips *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 169-174 (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N92-33501# National Inst. of Standards and Technology, Gaithersburg, MD.
PRELIMINARY SCREENING PROCEDURES AND CRITERIA FOR REPLACEMENTS FOR HALONS 1211 AND 1301 Final Report, Oct. 1989 - Sep. 1990
R. G. Gann, J. D. Barnes, S. Davis, J. S. Harris, and R. H. Harris Jul. 1991 326 p Sponsored by AFESC
(AD-A252912; NIST-TN-1278; ESL-TR-90-24) Avail: CASI HC A15/MF A03

Halons 1301 and 1211 are being restricted by the Montreal Protocol of 1987. This project facilitates identification of alternative chemicals by developing quick, inexpensive screening procedures for nine critical properties: fire suppression efficiency, ozone depletion potential, global warming potential, residue level, toxicity, long-term storage stability, metals corrosion, electrical conductivity, and compatibility with plastics. The procedures are straight forward to conduct, require about 5 moles of chemical, and can be performed in about 8 days for less than $15k. Concurrent testing of many chemicals would cost less. Sample purity is critical. The test results are reported in classes that relate to the performance of Halons 1211 and 1301. Examples of testing sequences are provided. Interpretation of the results requires expert judgment since weak performance in a test may not be the basis for rejecting a chemical. These methods and performance classes have been developed for screening purposes only and should not be used for final selection procurement regulation without more extensive evaluation. GRA

N92-33601*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
RECONFIGURING THE RUM EXPERIMENT TO TEST CIRCULAR SCANNING WITH ROTATING UNBALANCED-MASS DEVICES ON GIMBALED PAYLOADS
M. E. Polites and D. C. Alhorn Sep. 1992 19 p
(NASA-TP-3282; M-696; NAS 1.60:3282) Avail: CASI HC A03/MF A01

This paper describes a ground-based experiment designed to prove the concept of circular scanning a gimbaled payload with rotating unbalanced-mass (RUM) devices. The experiment is a modified version of a similar experiment which demonstrates line and raster scanning with RUM's. In this paper, a description of the experiment hardware is presented and a detailed design of the servos used in scanning is given. A computer simulation model of the entire system is discussed and simulation results are included. These verify the servo designs and show the RUM's to be an extremely power efficient method for circular scanning.
Author

N92-33612* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SHARPS CONTAINER Patent
Angelene M. Lee, inventor (to NASA) 8 Sep. 1992 5 p Filed 7 Oct. 1991 Supersedes N92-17913 (30 - 8, p 1278)
(NASA-Case-MSC-21776-1; US-Patent-5,145,063; US-Patent-Appl-SN-772763; US-Patent-Class-206-364; US-Patent-Class-206-366; US-Patent-Class-206-370; US-Patent-Class-206-818; US-Patent-Class-220-908; Int-Patent-Class-B65D-83/10) Avail: US Patent and Trademark Office

This invention relates to a system for use in disposing of potentially hazardous items and more particularly a Sharps receptacle for used hypodermic needles and the like. A Sharps container is constructed from lightweight alodined nonmagnetic metal material with a cup member having an elongated tapered shape and length greater than its transverse dimensions. A magnet in the cup member provides for metal retention in the container. A nonmagnetic lid member has an opening and spring biased closure flap member. The flap member is constructed from stainless steel. A Velcro patch on the container permits selective attachment at desired locations.
Official Gazette of the U.S. Patent and Trademark Office

N92-33637 National Physical Lab., Teddington (England). Materials Metrology Div.
A SIMPLE MODEL FOR THE VACUUM ARC REMELTING PROCESS
D. H. Ferriss and P. N. Quested Mar. 1992 45 p
(NPL-DMM(A)-61; ETN-92-91988) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

Equations describing the heat and mass tranfer taking place during the VAR (Vacuum Arc Remelting) process are presented. Allowance is made for buoyancy, electromagnetic, surface radiation, and surface shear effects. Solidification effects are modeled by the presence of a temperature dependent Darcy term in the momentum equations which immobilizes the flow. The model flow is assumed to be steady, laminar, and axisymmetric. A number of nondimensional parameter groups characterizing the flow are identified and their interactive role is discussed. The model equations are solved numerically using relaxation methods. Solutions could not be obtained for full scale operating conditions; however, some results are presented corresponding to increased viscosity values. For the operating conditions chosen, the calculated temperature distributions were found to be largely insensitive to any effects other than the magnitude and form of the thermal boundary conditions.
ESA

N92-33707*# National Inst. of Standards and Technology, Gaithersburg, MD. Building and Fire Research Lab.
AN ASSESSMENT OF THE NASA FLAMMABILITY SCREENING TEST AND RELATED ASPECTS OF MATERIAL FLAMMABILITY Final Report, Jul. 1989 - Jun. 1992
Thomas J. Ohlemiller Aug. 1992 45 p
(NASA Order C-32003-R; RTOP 323-53-62)
(NASA-CR-189226; NAS 1.26:189226; NISTIR-4882) Avail: CASI HC A03/MF A01

The results of an assessment of the NASA flammability screening test (8060.1B) for materials to be used in manned spacecraft interiors are summarized. A set of materials was examined using the standard NASA test, a modified version of this test which incorporated external radiation and National Institute of Standards and Technology (NIST) tests which measure ignitability, rate of heat release, and opposed flow flame spread behavior. Materials passing the standard NASA screening test showed widely varying degrees of flammability enhancement when subjected to external radiation (modified NASA test, NIST tests). Since such radiation is implicit in many normal fire scenarios, materials passing the standard NASA screening test should not be treated as non-flammable. The quantitative role of self-feedback of radiation remains to be fully clarified; an apparatus to examine this issue was built but no tests could be completed in the allotted time. The rate of heat release from the two-sided burning of thermally-thin materials was quantitatively compared to that for one-sided burning; this issue was believed to be at the heart of certain anomalies in the earlier stages of this study. A synergistic enhancement of heat release rate was indeed found for two-sided burning of three materials; two simplified models account for the origin of this effect. On the basis of this study, it is recommended that NASA supplement their existing flammability screening test with one that incorporates external radiation. It is further recommended that this supplemental test in normal gravity be correlated experimentally with a similar test in micro-gravity.
Author

N92-33327*# New Mexico Univ., Albuquerque. Engineering Research Inst.
A CENTER FOR EXTRATERRESTRIAL ENGINEERING AND CONSTRUCTION (CETEC)
Gerald G. Leigh *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 303-316 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33328*# General Dynamics Corp., San Diego, CA. Space Systems Div.
CRYOGENIC STORAGE TECHNOLOGY READINESS FOR FIRST LUNAR OUTPOST
John R. Schuster *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 317-335 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33329*# Houston Univ., TX. Inst. of Space Systems Operations.
RELATION OF THE LUNAR POWER SYSTEM TO THE SEI PROGRAM AND TO LANDERS
David R. Criswell and Robert D. Waldron (Waldron, Robert D., Hacienda Heights, CA) *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 347-363 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FAST TRACK LUNAR NTR SYSTEMS ASSESSMENT FOR THE FIRST LUNAR OUTPOST AND ITS EVOLVABILITY TO MARS
Stanley K. Borowski and Stephen W. Alexander *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 421-436 (For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

N92-33344*# Arizona Univ., Tucson. Telerobotics Lab.
PROPOSED LUNAR MISSIONS
Larry Schooley *In* NASA. Lyndon B. Johnson Space Center,

Third SEI Technical Interchange: Proceedings 1992 p 540-554 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33778# Nippon Electric Co. Ltd., Tokyo (Japan).
CONSTRUCTION OF MANNED LUNAR SURFACE SITES BY ROBOTS [ROBOTTO NI YORU YUUJIN GETSUMEN KYOTEN NO KOUCHIKU]
Toshiaki Okudaira, Kazuhide Todome, and Junko Takahashi (Nippon Electric Co. Ltd., Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 19 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33779# Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan).
CONSTRUCTION OF MANNED LUNAR SURFACE SITES [YUUJIN GETSUMEN KYOTEN NO KOUCHIKU]
Yoshinori Yuzawa, Michihiko Horie, Tetsuya Nakamura, Raita Amagata, and Tetsuya Honda *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 21 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33784# Obayashi Corp., Tokyo (Japan).
PRODUCTION OF CONSTRUCTION MATERIALS FOR LUNAR BASES Report No. 1 [GETSUMEN KICHI NO TAME NO KENSETSU ZAIRYOU NO SEISAKU]
Youji Ishikawa, Tetsumi Higasayama, Tetsuo Sasaki, Yukio Shimizu (Tokyo Univ., Japan), and Kyouichi Kuriki (Tokyo Univ., Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 16 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33785# Shimizu Corp. (Japan).
STRUCTURES AND CONSTRUCTION OF NUCLEAR POWER PLANTS ON LUNAR SURFACE [GETSUMEN NI OKERU GENSHI RO TATEYA NO KOUZOU TO SEKOU]
Katsunori Shimizu, Masuhiko Kobatake, Sachio Ogawa, Hiroshi Kanamori, Yasuhiko Okada, Hideyuki Mano, and Kenji Takagi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33786# Takenaka Works, Osaka (Japan). Technical Research Lab.
EXPERIMENTAL STUDY ON LUNAR UNDERGROUND BASE CONSTRUCTION BY GAS BALLOON METHOD [GASU BARUN KOUHOU NI YORU GETSUMEN CHIKA KICHI NO KENSETSU HOUHOU NO JIKKEN TEKI KENTOU]
Toshio Saitou, Takatoshi Ogawa, Katsutoshi Asai, and Yasushi Nakayama *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 9 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N92-33298*# Arizona State Univ., Tempe. Telecommunications Research Center.
ANTENNA PATTERN CONTROL USING IMPEDANCE SURFACES Semiannual Progress Report, 16 Mar. - 15 Sep. 1992
Constantine A. Balanis and Kefeng Liu 15 Sep. 1992 16 p
(Grant NAG1-1183)
(NASA-CR-190804; NAS 1.26:190804; TRC-EM-CAB-9204)
Avail: CASI HC A03/MF A01

During this research period, we have effectively transferred existing computer codes from CRAY supercomputer to work station based systems. The work station based version of our code preserved the accuracy of the numerical computations while giving a much better turn-around time than the CRAY supercomputer. Such a task relieved us of the heavy dependence of the supercomputer account budget and made codes developed in this research project more feasible for applications. The analysis of pyramidal horns with impedance surfaces was our major focus during this research period. Three different modeling algorithms in analyzing lossy impedance surfaces were investigated and compared with measured data. Through this investigation, we discovered that a hybrid Fourier transform technique, which uses the eigen mode in the stepped waveguide section and the Fourier transformed field distributions across the stepped discontinuities for lossy impedances coating, gives a better accuracy in analyzing lossy coatings. After a further refinement of the present technique, we will perform an accurate radiation pattern synthesis in the coming reporting period. Author

N92-33307*# Michigan Univ., Ann Arbor. Radiation Lab.
DEVELOPMENT OF 3D ELECTROMAGNETIC MODELING TOOLS FOR AIRBORNE VEHICLES Semiannual Progress Report, Feb. - Sep. 1992
John L. Volakis Sep. 1992 44 p
(Grant NAG2-541)
(NASA-CR-190810; NAS 1.26:190810; UMICH-025921-32-T)
Avail: CASI HC A03/MF A01

The main goal of this project is to develop methodologies for scattering by airborne composite vehicles. Although our primary focus continues to be the development of a general purpose code for analyzing the entire structure as a single unit, a number of other tasks are also pursued in parallel with this effort. These tasks are important in testing the overall approach and in developing suitable models for materials coatings, junctions and, more generally, in assessing the effectiveness of the various parts comprising the final code. Here, we briefly discuss our progress on the five different tasks which were pursued during this period. Our progress on each of these tasks is described in the detailed reports (listed at the end of this report) and the memoranda included. The first task described below is, of course, the core of this project and deals with the development of the overall code. Undoubtedly, it is the outcome of the research which was funded by NASA-Ames and the Navy over the past three years. During this year we developed the first finite element code for scattering by structures of arbitrary shape and composition. The code employs a new absorbing boundary condition which allows termination of the finite element mesh only 0.3 lambda from the outer surface of the target. This leads to a remarkable reduction of the mesh size and is a unique feature of the code. Other unique features of this code include capabilities to model resistive sheets, impedance sheets and anisotropic materials. This last capability is the latest feature of the code and is still under development. The code has been extensively validated for a number of composite geometries

and some examples are given. The validation of the code is still in progress for anisotropic and larger non-metallic geometries and cavities. The developed finite element code is based on a Galerkin's formulation and employs edge-based tetrahedral elements for discretizing the dielectric sections and the region between the target and the outer mesh termination boundary (ATB). This boundary is placed in conformity with the target's outer surface, thus resulting in additional reduction of the unknown count.

Author

N92-33391# Syracuse Univ., NY.
EFFECT OF NONLINEARITY ON RECEIVER SIGNAL TO DISTURBANCE RATIO IN HIGH SUBCLUTTER VISIBILITY Final Report, Sep. 1990 - Jun. 1991
Donald D. Weiner and Mohamed A. Slamani Dec. 1991 183 p
(Contract F30602-88-D-0027)
(AD-A252806; RL-TR-91-422) Avail: CASI HC A09/MF A02

Analyses of radar performance usually proceeds by assuming a linear receiver. In the presence of strong signals, however, actual receivers are subject to saturation effects. This nonlinear behavior can cause a significant change in the statistics of the disturbance. The purpose of this work is to study the effects of the nonlinearity of the radar receiver on the signal-to-disturbance ratio for the case of high subclutter visibility. The signal-to-disturbance ratio (SDR) is maximized using a transversal filter with adaptive weights. Three cases are considered in our research: Case 1: The receiver is linear and the weights of the transversal filter are computed so as to maximize the SDR. This case serves as a baseline against which the others are compared. Case 2: The receive is nonlinear. The weights of Case 1 are used for the transversal filter. Case 3: The receiver is nonlinear and the weights of the transversal filter are computed so as to maximize the SDR taking into account the effect of the nonlinearity. For all three cases, studies are made to determine how the SDR is affected when the following parameters are varied: (1) shape of the nonlinearity, (2) Doppler frequency, (3) clutter correlation, (4) thermal noise level, (5) clutter power level, and (6) number of pulses. GRA

N92-33437 McMaster Univ., Hamilton (Ontario).
NOVEL TECHNIQUES AND ARCHITECTURES FOR ADAPTIVE BEAMFORMING Ph.D. Thesis
Thua Van Ho Apr. 1990 201 p
(ISBN-0-315-57952-8; CTN-92-60562) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

Adaptive beamforming (AB) techniques offer possible solutions to the critical problems of interference and system antenna errors in communications and radar antenna systems. Novel AB techniques and architectures are developed, focusing on techniques in which the adaptation is performed by means of a triangular systolic array processor performing the QR decomposition. AB algorithms for a planar array or two dimensional (2-D) AB algorithms, typified by the 2-D least mean squares algorithm and the 2-D Howells Applebaum algorithm, are derived. The concept of 2-D eigenbeams is introduced to demonstrate the performance of 2-D AB techniques. The 2-D AB problem is also formulated in terms of the one dimensional case, with operation taking place along rows and chains of a planar array. The adaptive processor is then implemented by using a manifold of the least-squares triarray processors, which in the limit takes the form of a three dimensional systolic array. A new self calibration technique for overcoming the degradation in the output of the high performance algorithms is derived, based on the use of iteration, the eigen-based method, and the least-squares norm minimization. It is shown that the algorithm can automatically estimate the angles of arrival of the received signals and calibrate the array with minimum phase and gain errors. Results obtained by using both simulation and measurement data are given.

Author (CISTI)

N92-33438 McMaster Univ., Hamilton (Ontario).
PARALLEL IMPLEMENTATIONS OF THE KALMAN FILTER FOR TRACKING APPLICATIONS Ph.D. Thesis
Edward Kwang Bok Lee Mar. 1990 267 p
(ISBN-0-315-57962-5; CTN-92-60563) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

Parallel implementations of the extended covariance Kalman filter (ECKF) and the extended square root covariance filter (ESRCF) for tracking applications are disclosed. The use of the decoupling technique in the ECKF eliminates the need for a matrix inversion, and results in the time and measurement updates of m decoupled (n/m)-dimensional state estimate error covariance P0(k)'s instead of 1 coupled n-dimensional covariance matrix P(k), where m denotes the tracking dimension and n the number of state elements. Similarly, the use of the decoupling technique to the ESRCF separates the time and measurement updates of 1 coupled square root P(k) into those of m decoupled square root P0(k)'s. The updates of m decoupled matrices are found to require less computation than those of 1 coupled matrix, and they may be performed for each axis in parallel. In the parallel implementation of time and measurement updates of P(k) in the ECKF, the updates of m decoupled P0(k)'s are found to require about m times less number of processing elements and clock cycles than the updates of 1 coupled P(k)'s; an analogous phenomenon is found for parallel implementation in the ESRCF. The transformation of the Kalman gain which accounts for the decoupling of P(k) and square root P(k) is found easy to implement. The sparse nature of the measurement matrix and the sparse, band nature of the transition are explored to simplify matrix multiplications. Author (CISTI)

N92-33440 McMaster Univ., Hamilton (Ontario).
RADAR CLUTTER CLASSIFICATION Ph.D. Thesis
Wolfgang Stehwien Nov. 1989 373 p
(ISBN-0-315-57981-1; CTN-92-60565) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

The problem of classifying radar clutter as found on air traffic control radar systems is studied. An algorithm based on Bayes decision theory and the parametric maximum a posteriori probability classifier is developed to perform this classification automatically. This classifier employs a quadratic discriminant function and is optimum for feature vectors that are distributed according to the multivariate normal density. Separable clutter classes are most likely to arise from the analysis of the Doppler spectrum. Specifically, a feature set based on the complex reflection coefficients of the lattice prediction error filter is proposed. The classifier is tested using data recorded from L-band air traffic control radars. The Doppler spectra of these data are examined; the properties of the feature set computed using these data are studied in terms of both the marginal and multivariate statistics. Several strategies involving different numbers of features, class assignments, and data set pretesting according to Doppler frequency and signal to noise ratio were evaluated before settling on a workable algorithm. Final results are presented in terms of experimental misclassification rates and simulated and classified plane position indicator displays. Author (CISTI)

N92-33494# Pacific Northwest Lab., Richland, WA.
MEASUREMENT OF RADIOFREQUENCY FIELDS
J. A. Leonowich May 1992 30 p Presented at the 8th International Radiation Protection Association World Congress, Vancouver, Ottawa, 10-22 May 1992
(Contract DE-AC06-76RL-01830)
(DE92-015158; PNL-SA-20325; CONF-920501-21) Avail: CASI HC A03/MF A01

We are literally surrounded by radiofrequency (RFR) and microwave radiation, from both natural and man-made sources. The identification and control of man-made sources of RFR has become a high priority of radiation safety professionals in recent years. For the purposes of this paper, we will consider RFR to cover the frequencies from 3 kHz to 300 MHz, and microwaves from 300 MHz to 300 GHz, and will use the term RFR interchangeably to describe both. Electromagnetic radiation below 3 kHz is considered Extremely Low Frequency (ELF) and will not be discussed in this paper. Unlike x- and gamma radiation, RFR

is non-ionizing. The energy of any RFR photon is insufficient to produce ionizations in matter. The measurement and control of RFR hazards is therefore fundamentally different from ionizing radiation. The purpose of this paper is to acquaint the reader with the fundamental issues involved in measuring and safely using RFR fields. DOE

N92-33553# Sandia National Labs., Albuquerque, NM.
SINGLE-SHOT MEASUREMENT OF THE INTENSITY AND PHASE OF A FEMTOSECOND PULSE USING THE OPTICAL-KERR EFFECT
D. J. Kane (Los Alamos National Lab., NM.) and R. Trebino 1992 5 p Presented at the Nonlinear Optics: Materials, Fundamentals, and Applications, Maui, HI, 17-21 Aug. 1992
(Contract DE-AC04-76DR-00789)
(DE92-008510; SAND-92-8442C; CONF-920853-1) Avail: CASI HC A01/MF A01

We demonstrate the first technique for measuring the full electric field, E(t), of a single femtosecond pulse. It involves measuring the spectrum of polarization-spectroscopy optical-gate signal from glass as a function of delay. DOE

N92-33560# Naval Postgraduate School, Monterey, CA.
USE OF AN OPTICAL MULTICHANNEL ANALYZER FOR REFLECTIVITY MEASUREMENTS M.S. Thesis
David T. Moroney Mar. 1992 173 p
(AD-A252932) Avail: CASI HC A08/MF A02

Current theories that attempt to explain the emission and reflection properties of metallic surfaces still provide some room for conjecture and alternative concepts. This is true particularly for processes in the visible portion of the electromagnetic spectrum. One relatively new theory that has recently received increased attention and support is that of the 'native cluster' model. The model proposes that metallic surfaces are populated with small groups of atoms that have been liberated from the crystalline lattice structure of the bulk metal. These colloids possess dielectric qualities that act to modify basic properties of the parent material, such as polarizability, electrical conductivity, thermal emission, and luminescence. While proof of luminescence from metallic surfaces would not significantly detract from existing free electron and quantum theory, it would tend to support the 'native cluster' model. Due to its reflectivity characteristics, copper was selected as the metal to be studied in this research. One instrument that is well suited for the collection of reflectivity and emission data is the Optical Multichannel Analyzer. Although a powerful tool for spectral research, the requirement of a significant initial investment of time necessary to gain sufficient user familiarity to become proficient with the equipment has resulted in the instrument being underutilized. Therefore, in addition to the primary aim of this research in evaluating the ability of a polished copper surface to luminescence, a secondary aim was to evaluate the characteristics and applicability of this instrument to support the luminescence research. GRA

N92-33570*# GTE Government Systems Corp., Chantilly, VA.
ADVANCED ISDN SATELLITE DESIGNS AND EXPERIMENTS Final Report, 13 Sep. 1990 - 12 Sep. 1992
Gerard R. Pepin 12 Sep. 1992 156 p
(Contract NASw-4520)
(NASA-CR-190733; NAS 1.26:190733) Avail: CASI HC A08/MF A02

The research performed by GTE Government Systems and the University of Colorado in support of the NASA Satellite Communications Applications Research (SCAR) Program is summarized. Two levels of research were undertaken. The first dealt with providing interim services Integrated Services Digital Network (ISDN) satellite (ISIS) capabilities that accented basic rate ISDN with a ground control similar to that of the Advanced Communications Technology Satellite (ACTS). The ISIS Network Model development represents satellite systems like the ACTS orbiting switch. The ultimate aim is to move these ACTS ground control functions on-board the next generation of ISDN communications satellite to provide full-service ISDN satellite (FSIS) capabilities. The technical and operational parameters for the advanced ISDN communications satellite design are obtainable from the simulation of ISIS and FSIS engineering software models of the major subsystems of the ISDN communications satellite architecture. Discrete event simulation experiments would generate data for analysis against NASA SCAR performance measure and the data obtained from the ISDN satellite terminal adapter hardware (ISTA) experiments, also developed in the program. The Basic and Option 1 phases of the program are also described and include the following: literature search, traffic mode, network model, scenario specifications, performance measures definitions, hardware experiment design, hardware experiment development, simulator design, and simulator development. Author

N92-33584 Racal Communications, Inc., Rockville, MD.
METHOD AND APPARATUS FOR MAXIMISING EFFICIENCY IN SATELLITE COMMUNICATIONS Patent
Charles R. Baugh, inventor (to CISTI), Edwin J. Hilpert, inventor (to CISTI), George R. Kushin, inventor (to CISTI), Yoon B. Park, inventor (to CISTI), and William A. Dambrackas, inventor (to CISTI) 31 Jan. 1989 14 p
(CA-Patent-1-249-644; Int-Patent-Class-H04B-15/00; CTN-91-60146) Copyright Avail: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

This invention relates to the improvement of the data transmission capacity of data communication systems employing half duplex data transmission between terrestrial and satellite communication links. It also includes a method and apparatus which, without loss of data transmission efficiency, eliminates problems created by echoes. These advantages are achieved by provision of out-of-band tones transmitted in the absence of data and turning reception off when the tone is received. Receiver squelching is removed at the receiver when the receiver detects tone cessation. The removal of receiver squelching is synchronized with the arrival of data, eliminating the reception of echoes. Proper squelch timing is achieved regardless of the number of satellite links or other delay elements in the transmission path. CISTI

N92-33606# National Telecommunications and Information Administration, Washington, DC.
FEDERAL SPECTRUM USAGE OF THE 1710-1850 AND 2200-2290 MHz BANDS
Ernesto A. Cerezo Mar. 1992 141 p
(PB92-197193; NTIA-92-285) Avail: CASI HC A07/MF A02

The Spectrum Resource Assessment (SRA) is an integral part of the National Telecommunications and Information Administration (NTIA), Office of Spectrum Management (OSM) long-range planning process related to national and international interests that focus on radio frequency spectrum topics. The SRA includes a description of the current Federal Government spectrum use of the 1710-1850 MHz and 2200-2290 MHz bands and an estimate of the Federal Government investment in these bands. Specifically, the SRA provides updated information on allocations, technical standards, frequency assignments, channeling plans, and spectrum usage of the 1710-1850 MHz and 2200-2290 MHz bands. It also includes updated information on major systems currently operating or planned for operation in these bands and their technical or operational characteristics. Author

N92-33668# Defence Research Establishment, Ottawa (Ontario). Airborne Radar Section.
FREQUENCY REFERENCE REQUIREMENTS FOR A HIGH DYNAMIC RANGE RADAR
Glen Rempel Sep. 1991 56 p
(DREO-1086; CTN-92-60599) Avail: CASI HC A04/MF A01

A method is described for computing the frequency source stability requirement for an airborne pulse-Doppler radar system. The method does not rely on restrictive assumptions about the range or Doppler shift extent of ground clutter, and hence is applicable to situations where the antenna beamwidth is large relative to either or both of these parameters. Starting with information derived from an airborne radar simulator, general

equations are developed which express bounds on the four main representations used to describe a frequency reference. These are the single sideband amplitude modulation (AM) and phase modulation (PM) noise power spectra, and the spurious AM and PM signal power levels. Bounds for each of these functions are determined so as to minimize their effect on the post-processing signal to interference ratio. The technique is specifically applied to determine the frequency source stability requirements for a radar transceiver to be constructed for the Defence Research Establishment Ottawa. The transceiver has a very large beamwidth, on the order of 90 deg, and consequently simplified techniques to determine the specifications proved inadequate. Author (CISTI)

N92-33679# Stanford Univ., CA. Dept. of Applied Physics.
AN ALL-SOLID-STATE CHIRPED SOURCE FOR COHERENT OPTICAL RADAR Final Report
Robert L. Byer 15 Mar. 1992 43 p
(Contract N00014-88-K-0701)
(AD-A252880) Avail: CASI HC A03/MF A01

A low-noise, high-power, single-frequency, solid-state laser harmonically converted to the green is required to pump a single-frequency, singly-resonant, chirped, optical parametric oscillator. As work toward this new frequency agile source we have built and injection locked an 18 watt Nd:YAG slave laser with a 40 mW master laser to produce single frequency operation, generated 6.5 watts of 532 nm radiation at 36 percent efficiency by resonant second harmonic generation, and measured spectral and spatial mode characteristics of this laser. Toward an all-solid-state version of this laser we have designed a diode-laser-pumped Nd:YAG laser. All subsystems of this laser have been built and tested and the final construction of the laser is currently underway. In addition, we have built both a pulsed singly resonant optical parametric oscillator, and a low threshold cw doubly resonant optical parametric oscillator that operated at 80 percent conversion efficiency in a single axial mode. GRA

N92-33697# Illinois Univ., Chicago. Communications Lab.
PREPARATIONS OF PROCEEDINGS MANUSCRIPT FOR NATO-ARW-DIMRP 88 DIRECT AND INVERSE METHODS IN RADAR POLARIMETRY Final Report, 15 Feb. 1990 - 31 Jul. 1991
Wolfgang-Margin Boerner 30 Aug. 1991 214 p Meeting held in Bad Windsheim, Fed. Republic of Germany, 18-24 Sep. 1988
(Contract DAAL03-89-K-0075)
(AD-A250386) Avail: CASI HC A10/MF A03

The proceedings of a NATO Advanced Research Workshop on Direct and Inverse Methods in Radar Polarimetry are presented. This is the second ARW in a series of three NATO-ARW's dealing with direct and inverse methods in electromagnetic sensing, imaging and target identification versus clutter discrimination with applications to electromagnetic wideband, wide area surveillance of the terrestrial and planetary deep-earth, surface to atmospheric environments. During the first NATO-ARW-IMEI'88 (NATO-ASI, Series C-143, 1985), we assessed the inverse methods in electromagnetic imaging primarily for solving radar scattering problems, including mathematical and numerical inversion techniques and signal and image processing with specific emphasis on the vector (polarization) nature of electromagnetic fields. The resulting two part Proceedings are highly praised in the international literature resulting in an extraordinary high sales record which encouraged us to plan, to organize and execute this second ARW on the more specific topic of Direct and Inverse Methods in Radar Polarimetry: NATO-ARW-DIMRP'88 (NATO-ASI, Series C-350, Parts 1 and 2, 1981) emphasizing advancements made in polarimetric radar (POL-RAD) and in polarimetric synthetic-aperture radar (POL-SAR) theory, metrology, signal/image processing, and polarimetric technology. GRA

N92-33827*# Kansas Univ., Lawrence. Center for Research.
AN EXPERIMENT IN REMOTE MANUFACTURING USING THE ADVANCED COMMUNICATIONS TECHNOLOGY SATELLITE Final Technical Report
Costas Tsatsoulis and Victor Frost Oct. 1991 39 p
(Grant NAGw-2345)
(NASA-CR-190842; NAS 1.26:190842; TISL-TR-9200-01; NRA-90-OSSA-7) Avail: CASI HC A03/MF A01

The goal of the completed project was to develop an experiment in remote manufacturing that would use the capabilities of the ACTS satellite. A set of possible experiments that could be performed using the Advanced Communications Technology Satellite (ACTS), and which would perform remote manufacturing using a laser cutter and an integrated circuit testing machine are described in detail. The proposed design is shown to be a feasible solution to the offered problem and it takes into consideration the constraints that were placed on the experiment. In addition, we have developed two more experiments that are included in this report: backup of rural telecommunication networks, and remote use of Synthetic Aperture Radar (SAR) data analysis for on-site collection of glacier scattering data in the Antarctic. Author

N92-33871*# Akron Univ., OH. Dept. of Electrical Engineering.
FAULT ISOLATION DETECTION EXPERT (FIDEX). PART 1: EXPERT SYSTEM DIAGNOSTICS FOR A 30/20 GIGAHERTZ SATELLITE TRANSPONDER Final Report
John Durkin, Richard Schlegelmilch, and Donald Tallo 31 Mar. 1992 219 p
(Grant NAG3-923)
(NASA-CR-190840; NAS 1.26:190840) Avail: CASI HC A10/MF A03

LeRC has recently completed the design of a Ka-band satellite transponder system, as part of the Advanced Communication Technology Satellite (ACTS) System. To enhance the reliability of this satellite, NASA funded the University of Akron to explore the application of an expert system to provide the transponder with an autonomous diagnosis capability. The results of this research was the development of a prototype diagnosis expert system called FIDEX (fault-isolation and diagnosis expert). FIDEX is a frame-based expert system that was developed in the NEXPERT Object development environment by Neuron Data, Inc. It is a MicroSoft Windows version 3.0 application, and was designed to operate on an Intel i80386 based personal computer system. Author

N92-33873*# Akron Univ., OH. Dept. of Electrical Engineering.
GROUND TERMINAL EXPERT (GTEX). PART 2: EXPERT SYSTEM DIAGNOSTICS FOR A 30/20 GIGAHERTZ SATELLITE TRANSPONDER Final Report
John Durkin, Richard Schlegelmilch, and Donald Tallo 31 Mar. 1992 64 p
(Grant NAG3-923)
(NASA-CR-190841; NAS 1.26:190841) Avail: CASI HC A04/MF A01

A research effort was undertaken to investigate how expert system technology could be applied to a satellite communications system. The focus of the expert system is the satellite earth station. A proof of concept expert system called the Ground Terminal Expert (GTEX) was developed at the University of Akron in collaboration with the NASA Lewis Research Center. With the increasing demand for satellite earth stations, maintenance is becoming a vital issue. Vendors of such systems will be looking for cost effective means of maintaining such systems. The objective of GTEX is to aid in diagnosis of faults occurring with the digital earth station. GTEX was developed on a personal computer using the Automated Reasoning Tool for Information Management (ART-IM) developed by the Inference Corporation. Developed for the Phase 2 digital earth station, GTEX is a part of the Systems Integration Test and Evaluation (SITE) facility located at the NASA Lewis Research Center. Author

N92-33941# General Accounting Office, Washington, DC. National Security and International Affairs Div.
MILITARY SATELLITE COMMUNICATIONS. MILSTAR PROGRAM ISSUES AND COST-SAVING OPPORTUNITIES
Jun. 1992 55 p
(AD-A252179; GAO/NSIAD-92-121) Avail: CASI HC A04/MF A01

In 1981, DOD initiated the Milstar program to provide the President and military services with a survivable worldwide communications capability. The Milstar system consists of satellites, ground-based control stations, and various Army, Navy, and Air Force terminals. Author

N92-33944# Purdue Univ., West Lafayette, IN. Dept. of Mathematics.
ELECTROMAGNETIC INVERSE SCATTERING Final Report
Vaughan H. Weston 23 Jun. 1992 2 p
(Contract N00014-89-K-0003)
(AD-A252233) Avail: CASI HC A02/MF A01

The contract involves the 3-D inverse electromagnetic problem for lossy and gradient type material. In particular it is concerned with developing methods for determining the material properties of a scatterer from reflection data. Author

N92-33945 Department of the Navy, Washington, DC.
TRIANGULAR TARGET BOAT REFLECTOR Patent
Kenneth Aw, inventor (to Navy) 17 Mar. 1992 7 p Filed 1 Jul. 1991
(AD-D015305; US-Patent-5,097,265; US-Patent-Appl-SN-724085; US-Patent-Class-342-7) Avail: US Patent and Trademark Office

An array of twenty corner reflectors with each corner reflector consisting of three mutually perpendicular reflecting planes whose intersection lie at a common point is presented. The twenty corner reflectors are, in turn, configured to provide omni-directional reflection to incoming electromagnetic waves, while maintaining strong reflection characteristics. GRA

N92-33965# Sandia National Labs., Albuquerque, NM.
DESIGN OF THICK FREQUENCY SELECTIVE SURFACES WITH COMPLEX APERTURES: DICHROICS WITH CROSS-SHAPED AND STEPPED RECTANGULAR APERTURES
L. W. Epp (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), J. C. Chen (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), P. H. Stanton (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), and R. E. Jorgenson 1992 5 p Presented at the Institute of Electrical and Electronic Engineers-American Physical Society (IEEE-APS) International Symposium, Chicago, IL, 18-25 Jul. 1992
(Contract DE-AC04-76DP-00789)
(DE92-014267; SAND-92-0617C; CONF-920750-4) Avail: CASI HC A01/MF A01

The unit cell shape of thick frequency selective surfaces, or dichroic plate, is dependent on its frequency requirements. One aperture shape may be chosen to give wider bandwidths, and another chosen for sharper frequency roll-off. This is analogous to circuits where the need for differing frequency response determines the circuit topology. Acting as spatial frequency filters, dichroics are a critical component in supporting the Deep Space Network (DSN) for spacecraft command and control up links as well as spacecraft down links. Currently these dichroic plates separate S-band at 2.0 - 232 GHz from X-band at 8.4 - 8.45 GHz. But new spacecraft communication requirements are also calling for an up link frequency at 7.165 GHz. In addition future spacecraft such as Craft/Cassini will require dichroics effectively separating K(sub a)-band frequencies in the 31 - 35 GHz range. The requirements for these surfaces are low transmission loss of less than 0.1 dB at high power levels. Also it is important to maintain a minimal relative phase shift between polarizations for circular polarization transmission. More current work has shown the successful demonstration of design techniques for straight, rectangular apertures at an incident angle of 30 deg. The plates are air-filled due to power dissipation and noise temperature considerations. Up-link frequency powers approach 100 kW making dielectrics undesirable. Here we address some of the cases in which the straight rectangular shape may have limited usefulness. For example, grating lobes become a consideration when the bandwidth required to include the new frequency of 7.165 GHz conflicts with the desired incident angle of 30 deg. For this case, the cross shape's increased packing density and bandwidth could make it desirable. When a sharp frequency response is required to separate two closely spaced K(sub a)-band frequencies, the stepped rectangular aperture might be advantageous. DOE

N92-34017*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
FINITE DIFFERENCE TIME DOMAIN GRID GENERATION FROM AMC HELICOPTER MODELS
Robin L. Cravey Sep. 1992 12 p
(RTOP 505-64-70-01)
(NASA-TM-107679; NAS 1.15:107679) Avail: CASI HC A03/MF A01

A simple technique is presented which forms a cubic grid model of a helicopter from an Aircraft Modeling Code (AMC) input file. The AMC input file defines the helicopter fuselage as a series of polygonal cross sections. The cubic grid model is used as an input to a Finite Difference Time Domain (FDTD) code to obtain predictions of antenna performance on a generic helicopter model. The predictions compare reasonably well with measured data. Author

N92-34057# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Itlay).
[ACTIVITIES REPORT OF THE IEN (ISTITUTO ELETTROTECNICO NAZIONALE) GALILEO FERRARIS] Anuual Report, 1990
May 1991 251 p In ENGLISH and ITALIAN
(ETN-92-91354) Avail: CASI HC A12/MF A03

Progress in activities of the following departments is described: time, frequency and electromagnetic metrology; electrical metrology; photometry; acoustics; materials; electromechanics; systems engineering; and by the Study Centre for Television operating within IEN. The main scientific areas covered concern: structures on metrological quantities regarding primary measurement standards and the determination of fundamental physical constants, the dissemination of the measurement units of the SI system, and representation of Italy in the relevant international organizations; matter physics, with the study of magnetic materials of high critical temperature superconductors and amorphous thin film semiconductors, and with evaluation of magnetic, electrical, radiometric, photometric and acoustic properties of materials for specific applications; electrical equipment, mainly with researches and experimental activity aiming at improving characteristics, reliability and safety of low voltage devices and installations; techniques for information processing, with the development of techniques for image understanding and researches in reliability of complex systems. ESA

N92-34082# Lawrence Livermore National Lab., CA.
ELECTRO-ABSORPTION IN A POLYDIACETYLENE
Y. Kawabe, F. Jarka, N. Peyghambarian, and Dandan Guo Feb. 1992 12 p Presented at the Optical Probes of Conjugated Polymers Conference, Snowbird, UT, 19-22 Aug. 1991
(Contract W-7405-eng-48)
(DE92-014794; UCRL-JC-109731; CONF-9108168-2) Avail: CASI HC A03/MF A01

The electro-absorption in a DCH-polydiacetylene has been investigated both experimentally and theoretically. In addition to the red Stark shift of the exciton, a significant feature in the difference spectrum is observed at a higher energy. Within an interacting electron model (extended Peierls-Hubbard model), the roles played by the dipole allowed one-photon states and the dipole forbidden two-photon states are studied in detail. It is found that the high-energy signals in the difference spectrum is due to the strong field induced mixing of the one-photon state at the edge of a continuum structure, or conduction band in the language of band theory, with its neighboring two-photon states. Contributions to the electro-absorption from the one- and two-photon states cancel deep within the band. Three-photon resonance due to the band edge is expected in third harmonic generation (THG) and has been seen in both a PDA and in polysilanes. DOE

N92-34119# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
COMPLETENESS OF SCATTERING STATES FOR ROUGH INTERFACES
David H. Berman 27 Feb. 1992 23 p Sponsored by ONR
(AD-A253122) Avail: CASI HC A03/MF A01

Using energy conservation and causality considerations, the completeness of scattering states is established for plane waves impinging on an irregular interface. Provided certain limiting operations commute with differentiation, it is shown that surface waves need not be explicitly included in the Weyl representation of the Green's function in the presence of a rough interface. Rather surface waves are implicitly included through the poles of the scattering amplitudes. This result was used implicitly in a recently developed scheme to treat scattering in a duct using half-space scattering amplitudes. GRA

N92-34129# Naval Command, Control and Ocean Surveillance Center, San Diego, CA. RDT and E Div.
INTENTIONALLY SHORT-RANGE COMMUNICATIONS (ISRC) EXPLORATORY DEVELOPMENT PLAN Final Report, Jan. 1991 - Mar. 1992
J. Yen Jun. 1992 87 p
(NR Proj. C3125)
(AD-A253456; NRAD-TD-2286) Avail: CASI HC A05/MF A01

This document is an exploratory development plan for the Intentionally Short-Range Communications (ISRC) project. The USMC requirements and project objectives are quantified, then possible solutions identified and developed. Some of these ideas will be attempted to determine the best option(s) satisfying the USMC requirements. GRA

N92-34218*# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
RELATIONSHIP BETWEEN WIND, WAVES AND RADAR BACKSCATTER Status Report, 1 Dec. 1990 - 30 Nov. 1991
Kristina B. Katsaros and Serhad S. Ataktuerk 30 Nov. 1991 8 p
(Grant NAGw-1322)
(NASA-CR-190912; NAS 1.26:190912) Avail: CASI HC A02/MF A01

The aim of the research was to investigate the relationship between wind, waves, and radar backscatter from water surface. To this end, three field experiments with periods of 2 to 4 weeks were carried out during summer months in 1988, 1989 and 1990. For these periods, the University of Washington group provided (1) environmental parameters such as wind speed, wind stress, and atmospheric stratification through measurements of surface fluxes (of momentum, sensible heat and latent heat) and of air and water temperatures; and (2) wave height spectra including both the dominant waves and the short gravity-capillary waves. Surface flux measurements were performed by using our well tested instruments: a K-Gill twin propeller-vane anemometer and a fast response thermocouple psychrometer. Wave heights were measured by a resistance wire wave gauge. The University of Kansas group was responsible for the operation of the microwave radars. Author

N92-33338*# Mitre Corp., Washington, DC.
FEASIBILITY OF LUNAR COMMUNICATIONS USING THE TDRS 2
Michael A. Jordan *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 471-482
(For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33379*# National Inst. of Standards and Technology, Boulder, CO.
THE ROLE OF THE CONSULTATIVE COMMITTEE ON INTERNATIONAL RADIO (CCIR) IN TIME AND FREQUENCY
Roger East Beehler *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 321-33
(For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

N92-33468# Alcatel Espace, Toulouse (France).
DELAYS INTRODUCED BY TELECOMMUNICATIONS FOR TELESCIENCE [LES DELAIS INTRODUITS PAR LES TELECOMMUNICATIONS POUR LA TELESCIENCE]
Michel Hayard *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 79-82
In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

N92-33469# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
IMPLEMENTATION OF TELESCIENCE REQUIREMENTS FOR IN-ORBIT-INFRASTRUCTURE GROUND SEGMENT FOR OPERATIONS
J. Volpp and U. Christ *In its* Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 83-86 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N92-33251# California Univ., San Diego, La Jolla. Dept. of Physics.
SOURCES OF ANISOTROPY IN AMORPHOUS MAGNETIC THIN FILM Final Report, 1 Jul. 1989 - 31 Dec. 1991
Frances Hellman Apr. 1992 11 p
(Grant AF-AFOSR-0432-89)
(AD-A252296; AFOSR-92-0523TR) Avail: CASI HC A03/MF A01

Macroscopic magnetic anisotropy is induced in the amorphous rare earth transition metal alloys such as TB-Fe when they are prepared by vapor deposition processes. The role of the vapor deposition process in producing the structural anisotropy which underlies the magnetic anisotropy has been explored and results compared with proposed models. It was shown that the anisotropy is independent of the state of stress in the film during the growth, and does not depend on film thickness. The results are inconsistent with recently-proposed models. Most significantly, the anisotropy was shown to be induced by a thermally-activated growth process. This process was hypothesized to involve rearrangement of local adatom configurations into energetically-favorable orientations which minimize surface energy during growth, a process analogous to the frequently-observed crystallographic texturing of polycrystalline thin film. The anisotropy vanishes upon subsequent annealing of the films, emphasizing the critical role of the surface during growth. GRA

N92-33393# Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.
LOW DIELECTRIC CONSTANT INSULATORS AND GOLD METALLIZATION FOR GHz MULTI-CHIP MODULES Annual Report
Paul Kohl and Sue A. Bidstrup Jun. 1992 179 p
(Contract N00014-91-J-4008)
(AD-A252881) Avail: CASI HC A09/MF A02

The goal of this program is to investigate new dielectrics, metals and processes for the fabrication of multi-chip modules (MMC's)

which hold the promise of exceptional electrical performance in the GHz region in addition to high yield and high reliability. The low dielectric constant insulators are being evaluated through the fabrication of in-situ test structures using gold as the metallization. In the course of doing this evaluation, a simple process for gold MCM's has been investigated. A processing scheme using gold as the interconnection metallization in the module has been developed and is being characterized. The gold process has fewer process steps than the equivalent copper process and has a potentially lower cost, particularly when high reliability is important. A unique adhesion material is under investigation and is currently being evaluated by n-Chip. The adhesion material would result in a significant cost reduction in the manufacture of copper or gold MCM's. Future plans are included in section 2. GRA

N92-33421 McGill Univ., Montreal (Quebec). Dept. of Electrical Engineering.
ACCURATE AND CONSISTENT FORCE CALCULATION FOR FINITE ELEMENT MAGNETICS Ph.D. Thesis
James Stephan McFee Aug. 1989 172 p
(ISBN-0-315-63692-4; CTN-92-60559) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

Three net magnetostatic loading force formulations are commonly used for finite element based electromagnetic and electromechanical computer-aided analysis and design: the Maxwell stress method, the method of classical virtual work, and the local Jacobian derivative method. None of these seems sufficient to calculate reliable results at a reasonable cost without expert user interaction. A new, fully automatic, field-error tuned force method is presented. The formulation is based on a volume integration of the computed fields over the entire free space region enveloping the body under force. Numerical tests indicate the the new method is significantly more accurate and consistent than the other methods currently available at a comparable cost. In addition, three important benchmark force problems are introduced; these problems have been designed to model the principal characteristics found in most practical force systems. Many of the computational difficulties inherent to the currently available force methods are explained. A new restructuring of the relationships between the different force formulas is provided. Author (CISTI)

N92-33439 McMaster Univ., Hamilton (Ontario). Dept. of Electrical and Computer Engineering.
DEMODULATION/DECODING OF A DC FREE CONSTRUCTION OF THE GOSSET LATTICE Ph.D. Thesis
Norman Pierre Secord Nov. 1989 130 p
(ISBN-0-315-57978-1; CTN-92-60564) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

The 8-dimensional Gosset lattice offers an asymptotic coding gain of 3 dB over conventional pulse amplitude modulation and can be soft decision demodulated or decoded at a reasonable speed. A little-used definition of the Gosset lattice is revived and it is shown that codes derived from this construction exhibit a null at dc in their baseband spectrum. Such codes are useful as line codes for baseband signalling on channels that do not support a dc spectral component or for bandpass transmission where spectral shaping is required to combat symbol interference. To enable applications in the multi-megabit range of data transmission, a two-stage approach to demodulation was developed. The first stage makes a fast estimate of the transmitted vector and can declare erasures for unreliable estimates. This stage controls the throughput of the demodulator. The second stage corrects the occasional occurrence of an erasure and maintains the error performance of the lattice. To complete the decoder structure, a method of lexigraphic ordering of the signal set is outlined which leads to a compact set of decoder lookup tables used to obtain a binary message sequence from each demodulated vector. Finally, the effects of quantization on the probabilities of erasure and error are evaluated and results from a Monte Carlo simulation undertaken to verify the demodulator performance are presented.
Author (CISTI)

N92-33456# Lawrence Livermore National Lab., CA.
FEASIBILITY ASSESSMENT OF ELECTROMECHANICAL BATTERIES FOR ELECTRIC VEHICLES
W. J. Comfort, S. E. Bumpas, T. A. Edmunds, A. R. Hall, A. D. Lamont, H. K. McCue, and E. Zywicz May 1992 139 p
(Contract W-7405-eng-48)
(DE92-015172; UCRL-ID-109422) Avail: CASI HC A07/MF A02

We have assessed the current feasibility of substituting multi-shell composite flywheel motor-generators (electromechanical batteries) for electrochemical batteries in electric vehicles. We present two conceptual designs using the latest materials and technology. Feasibility was evaluated in terms of performance predictions based upon consistent and optimistic analytical models of components for these conceptual designs. We review various approaches for performance improvement. The most challenging issues are capital cost and energy storage performance. Energy storage per unit cost favors the electrochemical battery. The power density, specific power, efficiency, and turn-around efficiency can be higher for the electrochemical battery than for projected electrochemical batteries of the future. We conclude that for electric vehicles, electromechanical batteries may be best suited for a hybrid application with electrochemical batteries. This combines the high specific power, power density, and turn-around efficiency possible with the electrochemical battery with the low cost of the electrochemical battery. DOE

N92-33481*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
FABRICATION OF HIGH T(SUB c) SUPERCONDUCTOR THIN FILM DEVICES: CENTER DIRECTOR'S DISCRETIONARY FUND Final Report
R. C. Sisk Aug. 1992 16 p
(NASA-TM-103600; NAS 1.15:103600) Avail: CASI HC A03/MF A01

This report describes a technique for fabricating superconducting weak link devices with micron-sized geometries etched in laser ablated Y1Ba2Cu3O(x) (YBCO) thin films. Careful placement of the weak link over naturally occurring grain boundaries exhibited in some YBCO thin films produces Superconducting Quantum Interference Devices (SQUID's) operating at 77 K.
Author

N92-33530# North Carolina State Univ., Raleigh.
LOW TEMPERATURE DEPOSITION AND CHARACTERIZATION OF N- AND P-TYPE SILICON CARBIDE THIN FILMS AND ASSOCIATED OHMIC AND SCHOTTKY CONTACTS Semiannual Report, 1 Apr. - 30 Jun. 1992
Robert F. Davis Jun. 1992 49 p
(Contract N00014-92-J-1500)
(AD-A252363) Avail: CASI HC A03/MF A01

Gas-source MBE growth of epitaxial layers of 3C (beta)-SiC (111) on Si faces of 6H-SiC (0001) cut 3 - 4 deg towards zone axes (1120) was achieved at 1000 - 1250 C using C2H4 and Si2H6. The occurrence of 3C-SiC is attributed mainly to the lower surface mobility of the adsorbed species at the temperatures used in this research. Plan-view TEM and RHEED analysis showed a double positioning structure. This combination of high flow (total flow 2.5 sccm) and low temperatures (1050 C) resulted in a very high nucleation density which likely allowed interaction between nuclei very early in growth, leading to a smooth growth surface. Solid solutions and multilayers of AlN and SiC have been grown on 6H-SiC (0001) substrates cut 3 - 4 deg off-axis to zone axes (1120). Evidence is presented which suggests that the AlN-rich solid solutions are cubic. Multilayer structures of 6H-SiC, 2H-AlN, and 3C-SiC were also fabricated. Finally, studies to understand what controls contact electrical characteristics of specific metals to n-type 6H-SiC has continued in order to select the best ohmic and rectifying contacts. Current-voltage measurements have shown that Ti, Pt, and Hf contacts deposited at room temperature on n-type, (0001) 6H-SiC are rectifying, all with ideality factors between 1.01 and 1.09. The lowest leakage currents (-5 x 10(exp -8) A/sq

cm at -10 V) were found for unannealed Pt contacts and for Hf contacts annealed at 700 deg for 20 minutes. GRA

N92-33541# Ford Aerospace Corp., Palo Alto, CA. Space Systems Div.
HIGH TEMPERATURE SUPERCONDUCTIVITY SPACE EXPERIMENT (HTSSE), HYBRID HTS/DIELECTRIC RESONATOR BANDPASS FILTER Final Report, Aug. 1989 - Dec. 1991
J. Fiedziuszko and J. Curtis 2 Apr. 1992 140 p
(Contract N00014-89-C-2248)
(AD-A252814; Rept-3UR510-1) Avail: CASI HC A07/MF A02

Novel filter configurations utilizing dielectric resonators in combination with High Temperature Superconductors (HTS) were successfully developed and flight qualified for the High Temperature Superconductivity Space Experiment (HTSSE). All program goals were met and the developed filters exhibit the best electrical performance (extremely low insertion loss) reported to this date. The developed dielectric resonator probe technique for measurements of properties of HTS was instrumental to the success of the program, allowing for rapid selection of HTS film for flight filters. Filters and resonator configurations developed on this problem have the potential for extremely high Q factors (in the order of tens of millions) when very low loss, high dielectric constant materials such as sapphire (or similar compounds) are used. Higher power handling and precise tuning of the filters is also possible. GRA

N92-33542# Perugia Univ. (Italy).
1992 INTERNATIONAL WORKSHOP ON MILLIMETER WAVES
24 Apr. 1992 191 p Workshop held in Orvieto, Italy, 22-24 Apr. 1992 LIMITED REPRODUCIBILITY: Availability: Document partially illegible
(Contract DAJA45-92-M-0161)
(AD-A252817; R/D-6889-EE-02) Avail: CASI HC A09/MF A02

Fourteen papers addressing various topics in millimeter-wave applications are presented. Specific topics include passive microwave scanners, millimeter-wave integrated circuits and field effect transistors, nanometric structures, optical control of millimeter-wave circuits, and millimeter-wave passive components in suspended microstrip technology. M.G.

N92-33548 Department of the Navy, Washington, DC.
CIRCUITRY FOR COMPENSATING FOR TRANSISTOR PARAMETER MISMATCHES IN A CMOS ANALOG FOUR-QUADRANT MULTIPLIER Patent
Randy L. Shimabukuro, inventor (to Navy) and Patrick A. Shoemaker, inventor (to Navy) 17 Mar. 1992 13 p Filed 11 Apr. 1991
(AD-D015333; US-Patent-5,097,156; US-Patent-Appl-SN-685590; US-Patent-Class-307-491) Avail: US Patent and Trademark Office

The present invention provides a circuit for eliminating quadratic and offset errors in the output of a CMOS four-quadrant analog multiplier. These errors are eliminated by feedback circuits that each include one or more CMOS four-quadrant analog multipliers. GRA

N92-33575 Department of the Navy, Washington, DC.
PLANAR GALLIUM ARSENIDE NPNP MICROWAVE SWITCH Patent
Harvey S. Newman, inventor (to Navy) 4 Feb. 1992 5 p Filed 27 Jul. 1990
(AD-D015319; US-Patent-5,086,329; US-Patent-Appl-SN-558540; US-Patent-Class-357-37) Avail: US Patent and Trademark Office

A microwave switch is provided for controlling the transmission of microwave energy in a microstrip transmission line structure. The microwave switch comprises an electrically conducting ground plane in contact with one side of an undoped semiconductor material having on its other side a superlattice of gallium arsenide consisting of a periodic sequence of p- and n-doped gallium arsenide layers. P- and n-type regions are formed integral with and electrically connected to the superlattice, and first and second microstrip transmission lines are electrically connected to respective ones of the n- and p-type regions. GRA

N92-33604*# Barr Associates, Inc., Westford, MA.
IMAGE QUALITY, SPACE-QUALIFIED UV INTERFERENCE FILTERS Final Report, Jul. 1989 - Jul. 1991
Thomas A. Mooney 23 Sep. 1992 7 p
(Contract NAS7-1067)
(NASA-CR-190815; NAS 1.26:190815) Avail: CASI HC A02/MF A01

The progress during the contract period is described. The project involved fabrication of image quality, space-qualified bandpass filters in the 200-350 nm spectral region. Ion-assisted deposition (IAD) was applied to produce stable, reasonably durable filter coatings on space compatible UV substrates. Thin film materials and UV transmitting substrates were tested for resistance to simulated space effects. Author

N92-33608# Department of the Navy, Washington, DC.
NAVY PRIMARY AND SECONDARY BATTERIES: DESIGN AND MANUFACTURING GUIDELINES
Sep. 1991 171 p
(PB92-183516; NAVSO-P-3676) Avail: CASI HC A08/MF A02

The best practices for the specification, design, and manufacture of primary and secondary batteries most commonly used in military applications are provided. The scope was limited to lead-acid batteries (excluding submarine batteries), nickel-cadmium batteries, dry cell, thermal cells, and lithium cells (primaries only). Silver-Zinc batteries, secondary and primary, were purposely excluded since they represent a small portion of the military procurement and require a special treatment of their manufacture and quality assurance best practices. Author

N92-33648# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.
INVESTIGATIONS OF SELF HEATING OF VLSI MOS-TRANSISTORS Ph.D. Thesis [UNTERSUCHUNGEN ZUR SELBSTERHITZUNG VON VLSI MOS-TRANSISTOREN]
Andreas Wachter 1991 116 p In GERMAN
(ETN-92-92127) Avail: CASI HC A06/MF A02

The expected temperature increase of Very Large Scale Integration (VLSI) MOS (Metal Oxide Semiconductor) transistors was determined in dependency of transistor geometry, using a semianalytical model for the stationary and the transient case. The temperature increase inside the transistor, and the influence of self heating on the electrical behavior can be computed by a self consistent solution of thermal conduction equation and semiconductor equations for the static, two dimensional case. Computations for real short channel MOS transistors, with channel lengths between 0.5 and 3 micrometers were carried out and verified, using experimental electrical measuring data. ESA

N92-33671# Sandia National Labs., Albuquerque, NM.
DESIGN PROCEDURE AND CHARACTERIZATION FOR V-BAND STEPPED RIDGE WAVEGUIDE-TO-MICROSTRIP TRANSITION
E. M. Slayton, III Jun. 1992 42 p
(Contract DE-AC04-76DP-00789)
(DE92-016749; SAND-92-1271) Avail: CASI HC A03/MF A01

Waveguide-to-microstrip transitions are extremely important components of mm-wave communication systems because it is the interface between the signal processing circuitry and the transmitted/received signal. This report describes the design procedure, construction detail, and measurement of both 3 and 4 step stepped ridge waveguide (RWG) transitions. Both transitions had greater than 10 dB return loss over the frequency band of interest (57-63 GHz) while insertion loss was less than 1 dB. Also, the transition lengths were at least half as long as traditional finline transitions while having superior performance. These shorter lengths were achieved by violating the 'small-step' assumption usually used in RWG transition design. DOE

N92-33713# Argonne National Lab., IL.
IRREVERSIBILITY BEHAVIOR IN Ag-SHEATHED Bi-BASED SUPERCONDUCTING WIRES
S. X. Dou (New South Wales Univ., Kensington, Australia), H. K. Liu (New South Wales Univ., Kensington, Australia), Y. C. Guo (New South Wales Univ., Kensington, Australia), J. Wang (New South Wales Univ., Kensington, Australia), X. J. Jin (New South Wales Univ., Kensington, Australia), Q. Y. Hu (New South Wales Univ., Kensington, Australia), D. L. Shi, S. Salem-Sugui, and Z. Wang Apr. 1992 7 p Presented at the Material Research Society Spring Meeting, San Francisco, CA, 27 Apr. - 2 May 1992
(Contract W-31-109-eng-38)
(DE92-016698; ANL/CP-76361; CONF-920402-38) Avail: CASI HC A02/MF A01

Irreversibility lines for Ag/(Bi,Pb)2Sr2Ca2Cu3O(y)(2223) wires prepared through a phase formation- decomposition-recovery (PFDR) process and normal annealing process were determined using both AC susceptibility measurements under DC fields and magnetization measurements. It was found that flux pinning was enhanced in the PFDR processed samples over the normal processed samples, in particular at temperatures above 77 K. The PFDR process results in high mass density, grain alignment, uniform distribution of impurity precipitates, and high density of defects. The irreversibility temperatures scaled with the applied field according to H(sup 1/3), which is in contrast to H(sup 2/3) law for YBa2Cu3O(7-x) and conventional superconductors. The irreversibility lines for PFDR processed tapes showed a crossover with those for normal processed tapes at temperatures below T(sub c) of the (Bi,Pb)2Sr2CaCu2O(8+x) (2212), suggesting that at temperatures above T(sub c) of the 2212 phase, the 2212 as a nonsuperconducting region, may serve as effective pinning sites for fluxoids. DOE

N92-33814# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.
IMPACT OF TEMPERATURE CHANGES IN THE REPRESENTATION ACCURACY OF X RAY LITHOGRAPHY FOR THE PRODUCTION OF INTEGRATED CIRCUITS Ph.D. Thesis [AUSWIRKUNG VON TEMPERATURAENDERUNGEN AUF DIE ABBILDUNGSGENAUIGKEIT DER ROENTGENSTRAHLLITHOGRAPHIE ZUR HERSTELLUNG INTERGRIERTER SCHALTKREISE]
Jutta Trube 1991 120 p In GERMAN
(ETN-92-92143) Avail: CASI HC A06/MF A02

The influence of exposure on the image accuracy of X-ray lithography is examined. The temperature changes of the mask during the exposure and the thermoelectric potentials of the resulting delays are considered. The temperature distribution of the masks under stationary and dynamic exposure conditions is measured with an infrared camera. The results show that the temperature of the mask is determined by the thermal diffusion length in the mask and the absorber covering. It is shown that the temperature changes of the mask during the exposure represents no limitation of image accuracy for X-ray lithography. ESA

N92-33829# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Product Assurance and Safety Dept.
REQUIREMENTS FOR ESA-APPROVED SKILLS TRAINING AND CERTIFICATION (ELECTRONIC ASSEMBLY TECHNIQUES)
Mar. 1992 15 p
(ESA-PSS-01-748-Issue-1; ETN-92-91970) Copyright Avail: CASI HC A03/MF A01

The ESA requirements for skills training schools, for the manufacturing and assembly methods for spacecracft electronics, and the certification of operators and inspectors, following the ESA electronic assembly specifications, are addressed. Certificate categories, visual acuity, training records, training program evaluation, maintenance of certified status, and certification sources are detailed. ESA

N92-33926# Lehigh Univ., Bethlehem, PA.
LARGE SIGNAL CHARACTERIZATION AND MODELLING OF HETEROJUNCTION-BIPOLAR TRANSISTORS Annual Report, 1 Jun. 1991 - 31 May 1992
D. S. Whitefield, C. J. Wei, and J. C. Hwang 31 May 1992 12 p
(Grant AF-AFOSR-0302-90)
(AD-A253011; AFOSR-92-0662TR) Avail: CASI HC A03/MF A01

The high power operation of the heterojunction bipolar transistor (HBT) was analyzed by experimentally determining the junction temperature and separating temperature effects from other high power effects. In addition, an HBT large signal model was developed that is valid for the linear, saturation, and cutoff regions, with temperature effects included. This model was implemented in a commercial harmonic balance simulator LIBRA from EEsof, making it particularly suitable for the design and simulation of HBT microwave power integrated circuits. GRA

N92-33939# Sandia National Labs., Albuquerque, NM.
A TEMPERATURE DEPENDENT SPICE MACRO-MODEL FOR POWER MOSFETS
D. G. Pierce May 1992 123 p
(Contract DE-AC04-76DP-00789)
(DE92-015386; SAND-92-0852) Avail: CASI HC A06/MF A02

A power MOSFET macro-model for use with the circuit simulator SPICE was developed that is suitable for use over the temperature range of -55 to 125 C. The model is comprised of a single parameter set with the temperature dependence accessed through the SPICE TEMP card. This report describes in detail the development of the model and the extraction algorithms used to obtain model parameters. The extraction algorithms are described in sufficient detail to allow for automated measurements which in turn allows for rapid and cost effective development of an accurate SPICE model for any power MOSFET. DOE

N92-33980# California Univ., Berkeley. Lawrence Berkeley Lab.
CHARGE-SENSITIVE POLY-SILICON TFT AMPLIFIERS FOR a-Si:H PIXEL PARTICLE DETECTORS
Gyuseong Cho, V. Perez-Mendez, M. Hack (Xerox Palo Alto Research Center, CA.), and A. Lewis (Xerox Palo Alto Research Center, CA.) Apr. 1992 7 p Presented at the Material Research Society Spring Meeting, San Francisco, CA, 27 Apr. - 2 May 1992
(Contract DE-AC03-76SF-00098)
(DE92-016915; LBL-32219; CONF-920402-41) Avail: CASI HC A02/MF A01

Prototype charge-sensitive poly-Si TFT amplifiers have been made for the amplification of signals (from an a-Si:H pixel diode used as an ionizing particle detector). They consist of a charge-sensitive gain stage, a voltage gain stage and a source follower output stage. The gain-bandwidth product of the amplifier is approximately 300 MHz. When the amplifier is connected to a pixel detector of 0.2 pF, it gives a charge-to-voltage gain of approximately 0.02 mV/electrons with a pulse rise time less than 100 nsec. An equivalent noise charge of the front-end TFT is approximately 1000 electrons for a shaping time of 1 microsec. DOE

N92-34033# California Univ., Los Angeles. Dept. of Physics.
QUANTUM FLUCTUATIONS IN MESOSCOPIC SYSTEMS, 2 Progress Report, 1990-1991
1991 18 p
(Contract DE-FG03-88ER-45378)
(DE92-015609; DOE/ER-45378/T3) Avail: CASI HC A03/MF A01

This summarizes results from the current DOE funding period (9/88-9/91). Analytical results are presented on the subject of the universal conductance fluctuations in mesoscopic conductors, in particular, the connection with low temperature 1/F noise magnitudes in disordered systems. Correlations in laser speckle patterns are discussed, and other results on the quantum transport in mesoscopic electronic systems are described. DOE

N92-34201*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
USER'S GUIDE TO THE RELIABILITY ESTIMATION SYSTEM TESTBED (REST)
David M. Nicol (College of William and Mary, Williamsburg, VA.), Daniel L. Palumbo, and Adam Rifkin (College of William and Mary, Williamsburg, VA.) Jun. 1992 91 p
(RTOP 505-64-10-07)
(NASA-TM-107596; NAS 1.15:107596) Avail: CASI HC A05/MF A01

The Reliability Estimation System Testbed is an X-window based reliability modeling tool that was created to explore the use of the Reliability Modeling Language (RML). RML was defined to support several reliability analysis techniques including modularization, graphical representation, Failure Mode Effects Simulation (FMES), and parallel processing. These techniques are most useful in modeling large systems. Using modularization, an analyst can create reliability models for individual system components. The modules can be tested separately and then combined to compute the total system reliability. Because a one-to-one relationship can be established between system components and the reliability modules, a graphical user interface may be used to describe the system model. RML was designed to permit message passing between modules. This feature enables reliability modeling based on a run time simulation of the system wide effects of a component's failure modes. The use of failure modes effects simulation enhances the analyst's ability to correctly express system behavior when using the modularization approach to reliability modeling. To alleviate the computation bottleneck often found in large reliability models, REST was designed to take advantage of parallel processing on hypercube processors.
Author

N92-34204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
C-BAND SUPERCONDUCTOR/SEMICONDUCTOR HYBRID FIELD-EFFECT TRANSISTOR AMPLIFIER ON A LaAlO3 SUBSTRATE
J. J. Nahra (Cincinnati Univ., OH.), K. B. Bhasin, S. S. Toncich, G. Subramanyam (Cincinnati Univ., OH.), and V. J. Kapoor (Cincinnati Univ., OH.) Sep. 1992 6 p Presented at the 1992 Applied Superconductivity Conference, Chicago, IL, 23-26 Aug. 1992; sponsored by IEEE
(Contract NCC3-33; RTOP 506-72-1B)
(NASA-TM-105828; E-7263; NAS 1.15:105828) Avail: CASI HC A02/MF A01

A single-stage C-band superconductor/semiconductor hybrid field-effect transistor amplifier was designed, fabricated, and tested at 77 K. The large area (1 inch x 0.5 inches) high temperature superconducting Tl-Ba-Ca-Cu-O (TBCCO) thin film was rf magnetron sputtered onto a LaAlO3 substrate. The film had a transition temperature of about 92 K after it was patterned and etched. The amplifier showed a gain of 6 dB and a 3 dB bandwidth of 100 MHz centered at 7.9 GHz. An identical gold amplifier circuit was tested at 77 K, and these results are compared with those from the hybrid amplifier.
Author

N92-34219*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
LOAD CONVERTER INTERACTIONS WITH THE SECONDARY SYSTEM IN THE SPACE STATION FREEDOM POWER MANAGEMENT AND DISTRIBUTION DC TEST BED
Ramon C. Lebron Aug. 1992 9 p Presented at the 27th Intersociety Energy Conversion Engineering Conference, San Diego, CA, 3-7 Aug. 1992; sponsored by ANS, SAE, ACS, AIAA, ASME, and IEEE
(RTOP 474-42-10)
(NASA-TM-105844; E-7287; NAS 1.15:105844) Avail: CASI HC A02/MF A01

The NASA LeRC in Cleveland, Ohio, is responsible for the design, development, and assembly of the Space Station Freedom (SSF) Electrical Power System (EPS). In order to identify and understand system level issues during the SSF Program design and development phases, a system Power Management and Distribution (PMAD) DC test bed was assembled. Some of the objectives of this test bed facility are the evaluation of, system efficiency, power quality, system stability, and system protection and reconfiguration schemes. In order to provide a realistic operating scenario, dc Load Converter Units are used in the PMAD dc test bed to characterize the user interface with the power system. These units are dc to dc converters that provide the final system regulation before power is delivered to the load. This final regulation is required on the actual space station because the majority of user loads will require voltage levels different from the secondary bus voltage. This paper describes the testing of load converters in an end to end system environment (from solar array to loads) where their interactions and compatibility with other system components are considered. Some of the system effects of interest that are presented include load converters transient behavior interactions with protective current limiting switchgear, load converters ripple effects, and the effects of load converter constant power behavior with protective features such as foldback.
Author

N92-33366*# Parzen (Benjamin), San Diego, CA.
UNIVERSAL, COMPUTER FACILITATED, STEADY STATE OSCILLATOR, CLOSED LOOP ANALYSIS THEORY AND SOME APPLICATIONS TO PRECISION OSCILLATORS
Benjamin Parzen *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 177-18 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

N92-33367*# Ball Corp., Irvine, CA. Efratom Div.
MEASUREMENT OF PRECISION OSCILLATOR PHASE NOISE USING THE TWO-OSCILLATOR COHERENT DOWN-CONVERSION TECHNIQUE
Christopher J. Pagnanelli and William F. Cashin *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 189-20 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N92-33269# Argonne National Lab., IL.
AUTOMATIC DIFFERENTIATION FOR PDES: UNSATURATED FLOW CASE STUDY
G. F. Corliss, C. Bischof, A. Griewank, S. J. Wright, and T. Robey (Spectra Research Inst., Albuquerque, NM.) 1992 11 p Presented at the 7th International Association of Mathematics and Computer Simulation (IMACS) International Conference on Computer Methods for Partial Differential Equations, New Brunswick, NJ, 22-24 Jun. 1992
(Contract W-31-109-eng-38)
(DE92-016782; ANL/CP-76461; CONF-9206185-3) Avail: CASI HC A03/MF A01

The techniques of automatic differentiation are applied to an example partial differential equation arising from the modeling of unsaturated flow. One common paradigm for the numerical solution to some classes of two-, three-, or higher-dimensional partial differential equations is as follows: given a PDE and boundary conditions, apply finite difference or finite element approximations on some appropriate (frequently nonuniform) grid, and enforce an approximate solution by solving a nonlinear system $F(u) = 0$ for the residual by Newton's method. The dimension of the nonlinear system $F(u) = 0$ is proportional to the number of grid points. In

current algorithms, the Jacobian (J) required by Newton's method is computed by some combination of hand coding, divided differences, matrix coloring, and partial separability. We present a case study documenting the steps we took in analyzing a code for modeling unsaturated flow in porous media. Our purpose was to compute J by automatic differentiation using ADOL-C, a tool for automatic differentiation using overloaded operators in C++. DOE

N92-33293# Cambridge Univ. (England). Dept. of Engineering.
FEEDBACK STABILIZATION HYDRODYNAMIC INSTABILITIES Final Report, 1 Aug. 1989 - 31 Jul. 1991
M. Gaster Dec. 1991 116 p
(Grant AF-AFOSR-0519-89)
(AD-A250898; AFOSR-92-0364TR) Avail: CASI HC A06/MF A02

The stabilization of boundary layers via control is compared to passive boundary layer control techniques. To date, all experimental disturbances have been in the laminar boundary layer. Further improvement in the level of disturbance attenuation in the boundary layer requires a three dimensional approach. The goal of this study was to control the boundary layer response to random three dimensional disturbances introduced near the leading edge of a flat plate. This goal was not fully achieved in the shortened time frame of this investigation. The basic flow structure to be controlled is the three-dimensional wave packet, i.e., the boundary layer response to localized pulse excitation. Since the control is to take place in the linear region of the transition zone, any conceivable flow disturbance can be synthesized and hence cancelled by appropriate wave packet superposition. GRA

N92-33405# National Inst. for Fusion Science, Nagoya (Japan).
DENSITY-CARRYING PARTICLE METHOD FOR FLUID
S. Kawata (Nagaoka Technological Univ., Japan), M. Shiromoto (Nagaoka Technological Univ., Japan), and T. Teremoto (Nagaoka Technological Univ., Japan) Nov. 1991 28 p Sponsored in part by Ministry of Education and Culture
(NIFS-120) Avail: CASI HC A03/MF A01

A new particle method in which a numerical particle carries the density of physical quantities, is introduced and discussed in this paper. In the conventional particle-in-cell (PIC) method, particles do not carry the density of physical quantities but carry the mass, momentum, and energy. In order to simulate the large change in the physical quantities, it is necessary to change the particle size. However the change in the particle size in the conventional PIC method may lead an unphysical error, when it is applied inappropriately. Our particles carrying the density eliminate this unphysical error and can represent the large change in the physical quantities. One of example computations shows that in an adiabatic expansion the four figures of density change can be successfully simulated. Author

N92-33420# SRI International Corp., Menlo Park, CA.
FORMATION AND PROPAGATION OF LOVE WAVES FROM A P-WAVE SOURCE Final Report, 25 Jan. 1989 - 31 Jan. 1992
A. L. Florence, S. A. Miller, and S. W. Kirkpatrick Jan. 1992 51 p
(Contract F19628-89-K-0009; SRI Proj. 7206)
(AD-A252851; PL-TR-92-2034; AD-E201049) Avail: CASI HC A04/MF A01

The objective of this research is to experimentally investigate and support, by finite element calculations, the formation and propagation of Love waves from a P-wave source due to scattering at material heterogeneities. A series of experiments were conducted where surface strains were measured parallel and perpendicular to a planar granite scattering surface. The granite wall that is cast in a surface layer waveguide of a low-impedance grout and then cast on a granite base provided the interface for generating horizontally polarized (SH) waves in the surface layer. The in-plane shear waves are the Love waves we measured at the surface. The P-wave source was a 1-cm-diameter spherical explosive of PETN diluted with microballoons to provide a charge density of 0.45 g/cm cast in a styrofoam sphere to further attenuate the peak pressure. We successfully measured the strains at three locations parallel to the wall and two locations perpendicular to the wall, and the test repeatability was good. Good agreement was also observed between the measured and calculated strain at all locations. The code calculations also showed that in-plane shear strains form along the surface layer/granite interface, and these shear strains propagate with little reduction in amplitude but transform relatively high-frequency oscillations to low-frequency wave packets. The experimental configuration used to generate and measure Love waves, an evaluation of the source used in the surface layer experiments, and results from finite element code calculations of the experiment are presented. GRA

N92-33451# Sandia National Labs., Albuquerque, NM.
VISCOSITY AND THE DISTRIBUTION OF ORIENTATIONS IN CONFINED SUSPENSIONS OF ROD-LIKE PARTICLES
R. Mor (Ben Gurion Univ. of the Negev, Beersheva, Israel), M. Gottlieb (Ben Gurion Univ. of the Negev, Beersheva, Israel), A. L. Graham (Los Alamos National Lab., NM.), and L. A. Mondy 1992 3 p Presented at the 11th International Congress of Rheology, Brussels (Belgium), 17-21 Aug. 1992
(Contract DE-AC04-76DP-00789)
(DE92-014615; SAND-92-0753C; CONF-920852-4) Avail: CASI HC A01/MF A01

In order to resolve questions regarding the source of the extended linear viscosity-concentration regime in rod-like systems, the distribution of orientations in confined systems has to be determined and related to changes in viscosity. In this work we describe our experimental and computer simulation studies on systems of neutrally buoyant suspensions of rod-like particles confined by the walls of a cylindrical container. DOE

N92-33452# Pittsburgh Energy Technology Center, PA.
BOUNDARY LAYER FLOW AND HEAT TRANSFER ANALYSIS OF A SECOND-GRADE FLUID
M. Massoudi and M. Ramezan (Burns and Roe Services Corp., Pittsburgh, PA.) Apr. 1992 56 p
(DE92-014743; DOE/PETC-TR/92/5) Avail: CASI HC A04/MF A01

Boundary layer flow and heat transfer analysis of a homogeneous, incompressible, non-Newtonian fluid of grade two at a stagnation point is presented. The flow is assumed to be steady and laminar. A power-law representation is assumed for the velocity distribution and wall temperature variation. The governing equations are solved using an iterative central difference approximation method in a non-uniform grid domain. This analysis show the effect of non-Newtonian nature of the fluid and the effect of suction/injection on the velocity profile. The effect of non-Newtonian nature of the fluid on the heat transfer coefficient at the wall for different values of Prandtl number and wall-temperature variation is also presented. DOE

N92-33535*# Stanford Univ., CA. Dept. of Aeronautics and Astronautics.
SENSITIVITY OF THE STRUCTURE OF UNTRIPPED MIXING LAYERS TO SMALL CHANGES IN INITIAL CONDITIONS
M. W. Plesniak, J. H. Bell, and R. D. Mehta Aug. 1992 19 p
(Contract NCC2-55; NSF MSM-88-15670)
(NASA-CR-190803; NAS 1.26:190803; JIAA-TR-107) Avail: CASI HC A03/MF A01

An experimental study was conducted concerning the influence of small changes in initial conditions on the near- and far-field evolution of the three-dimensional structure of a plan mixing layer. A two-stream mixing layer with a velocity ratio of 0.6 was generated with the initial boundary layers on the splitter plate laminar and was nominally two-dimensional. The initial conditions were changed slightly by interchanging the high- and low-speed sides of the wind tunnel, while maintaining the same velocities, and hence velocity ratio. This resulted in small changes in the initial boundary layer properties, and the perturbations present in the boundary layers were interchanged between the high- and low-speed sides for the two cases. The results indicate that, even with this relatively minor change in initial conditions, the near-field regions of the

two cases differ significantly. The peak Reynolds stress levels in the near-field differ by up to 100 percent, and this is attributed to a difference in the location of the initial spanwise vortex roll-up. In addition, the positions and shapes of the individual streamwise vortical structures differ for the two cases, although the overall structures differ for the two cases, although the overall qualitative description of these structures is comparable. The subsequent reorganization and decay of the streamwise vortical structures is very similar for the two cases. As a result, in the far field, both mixing layers achieve similar structure, yielding comparable growth rates, Reynolds stress, distribution, and spectral content. Author

N92-33564# University of Southern Illinois, Carbondale. Dept. of Physics.
ELECTRO-RHEOLOGY FLUIDS AND LIQUID FUEL FLOW Annual Report, 1 Jul. 1991 - 30 Jun. 1992
Rongjia Tao 30 Jun. 1992 20 p
(Contract N00014-90-J-4041)
(AD-A252950) Avail: CASI HC A03/MF A01

Goals of this research are: (1) to understand and clarify the physical mechanism underlying the electro-rheological (ER) response of fluids and establish a theory for the phenomenon; (2) to study the structure of ER fluids and their properties, to investigate the change of viscosity of ER fluids with an applied electric field; (3) to apply the ER phenomenon to liquid fuel flows, to control their viscosity and hence their velocity; (4) to examine the necessary theoretical and technique problems associated to the design of a new class of liquid fuel control devices which are based on the ER phenomenon. GRA

N92-33572*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
INVISCID VORTEX MOTIONS IN WEAKLY THREE-DIMENSIONAL BOUNDARY LAYERS AND THEIR RELATION WITH INSTABILITIES IN STRATIFIED SHEAR FLOWS Final Report
Nicholas D. Blackaby (Manchester Univ., England) and Meelan Choudhari (High Technology Corp., Hampton, VA.) Aug. 1992 20 p Submitted for publication
(Contracts NAS1-18605; NAS1-18240; NAS1-19480; RTOP 505-90-52-01)
(NASA-CR-189696; NAS 1.26:189696; ICASE-92-41) Avail: CASI HC A03/MF A01

We consider the inviscid instability of three-dimensional boundary-layer flows with a small crossflow over locally concave or convex walls, along with the inviscid instability of stratified shear flows. We show how these two problems are closely related through the forms of their governing equations. A proposed definition of a generalized Richardson number for the neutrally stable inviscid vortex motions is given. Implications of the similarity between the two problems are discussed. Author

N92-33587*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
FULLY NONLINEAR GOERTLER VORTICES IN CONSTRICTED CHANNEL FLOWS AND THEIR EFFECT ON THE ONSET OF SEPARATION Final Report
James P. Denier (New South Wales Univ., Kensington, Australia) and Philip Hall (Manchester Univ., England) Jul. 1992 34 p Submitted for publication
(Contract NAS1-18605; RTOP 505-90-52-01)
(NASA-CR-189679; NAS 1.26:189679; ICASE-92-29) Avail: CASI HC A03/MF A01

The development of fully nonlinear Goertler vortices in high Reynolds number flow in a symmetrically constricted channel is investigated. Attention is restricted to the case of 'strongly' constricted channels considered by Smith and Daniels (1981) for which the scaled constriction height is asymptotically large. Such flows are known to develop a Goldstein singularity and subsequently become separated at some downstream station past the point of maximum channel constriction. It is shown that these flows can support fully nonlinear Goertler vortices, of the form elucidated by Hall and Lakin (1988), for constrictions which have an appreciable region of local concave curvature upstream of the position at which separation occurs. The effect on the onset of separation due to the nonlinear Goertler modes is discussed. A brief discussion of other possible nonlinear states which may also have a dramatic effect in delaying (or promoting) separation is given. Author

N92-33610*# Engineering Research and Consulting, Inc., Huntsville, AL.
DEVELOPMENT OF A CFD CODE FOR CASTING SIMULATION Interim Report, Sep. 1992
Jesse E. Murph 16 Sep. 1992 65 p Original contains color illustrations
(Contract NAS8-39241)
(NASA-CR-190740; NAS 1.26:190740; ERC/HSV-TR92-06)
Avail: CASI HC A04/MF A01; 6 functional color pages

The task of developing a computational fluid dynamics (CFD) code to accurately model the mold filling phase of a casting operation was accomplished in a systematic manner. First the state-of-the-art was determined through a literature search, a code search, and participation with casting industry personnel involved in consortium startups. From this material and inputs from industry personnel, an evaluation of the currently available codes was made. It was determined that a few of the codes already contained sophisticated CFD algorithms and further validation of one of these codes could preclude the development of a new CFD code for this purpose. With industry concurrence, ProCAST was chosen for further evaluation. Two benchmark cases were used to evaluate the code's performance using a Silicon Graphics Personal Iris system. The results of these limited evaluations (because of machine and time constraints) are presented along with discussions of possible improvements and recommendations for further evaluation. Author

N92-33690# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Luft- und Raumfahrttechnik.
AXI-SYMMETRIC NATURAL FREQUENCIES AND RESPONSE OF A SPINNING LIQUID COLUMN UNDER STRONG SURFACE TENSION
Helmut F. Bauer 1991 29 p
(LRT-WE-9-FB-5-1991; ETN-92-91912) Avail: CASI HC A03/MF A01

The response of a solidly rotating anchored finite liquid column consisting of frictionless liquid is subjected to axial harmonic excitation. The response of the free liquid surface elevation and velocity distribution were determined analytically in the elliptic and hyperbolic frequency range. For the liquid surface displacement the response was evaluated numerically as a function of the forcing frequency. The first natural stuck-edge frequency was determined and compared with the slipping case. ESA

N92-33700# National Inst. for Fusion Science, Nagoya (Japan).
RELAXED STATE OF ENERGY IN INCOMPRESSIBLE FLUID AND INCOMPRESSIBLE MHD FLUID
Yoshiomi Kondoh (Gunma Univ., Maebashi, Japan) Dec. 1991 15 p
(NIFS-123) Avail: CASI HC A03/MF A01

Two examples of application of the general principle to find relaxed states are presented. These examples discuss results concerning the relaxed flow profile given by del x u = (kappa)u in the incompressible viscous fluid and the relaxed state given by (del x B = (lambda)B and del x u = (kappa)u) in the incompressible viscous magnetohydrodynamic (MHD) fluid. The former result suggests that some common phenomena are expected to be observed in the reversed field pinch plasma and in the incompressible viscous fluid. The latter one is expected to have some connections with the field profile of B and the flow pattern of u in the magmas as a result of the earth dynamo. Author

N92-33712# Westinghouse Savannah River Co., Aiken, SC.
MODFLOW 2.0: A PROGRAM FOR PREDICTING MODERATOR FLOW PATTERNS
P. F. Peterson and I. K. Paik Jul. 1991 74 p

(Contract DE-AC09-89SR-18035)
(DE92-016491; WSRC-TR-91-448) Avail: CASI HC A04/MF A01

Sudden changes in the temperature of flowing liquids can result in transient buoyancy forces which strongly impact the flow hydrodynamics via flow stratification. These effects have been studied for the case of potential flow of stratified liquids to line sinks, but not for moderator flow in SRS reactors. Standard codes, such as TRAC and COMMIX, do not have the capability to capture the stratification effect, due to strong numerical diffusion which smears away the hot/cold fluid interface. A related problem with standard codes is the inability to track plumes injected into the liquid flow, again due to numerical diffusion. The combined effects of buoyant stratification and plume dispersion have been identified as being important in the operation of the Supplementary Safety System which injects neutron-poison ink into SRS reactors to provide safe shutdown in the event of safety rod failure. The MODFLOW code discussed here provides transient moderator flow pattern information with stratification effects, and tracks the location of ink plumes in the reactor. The code, written in Fortran, is compiled for Macintosh II computers, and includes subroutines for interactive control and graphical output. Removing the graphics capabilities, the code can also be compiled on other computers. With graphics, in addition to the capability to perform safety related computations, MODFLOW also provides an easy tool for becoming familiar with flow distributions in SRS reactors. DOE

N92-33820 Washington Univ., Seattle.
A NUMERICAL STUDY OF LONGITUDINAL VORTEX INTERACTION WITH A TURBULENT BOUNDARY LAYER Ph.D. Thesis
Loganathan Sankaran 1991 131 p
Avail: Univ. Microfilms Order No. DA9131707

A numerical study of strong longitudinal vortices embedded in and interacting with a turbulent boundary layer was carried out using a reduced set of Navier-Stokes equations. The physical processes behind the vortex interaction with a flat-plate boundary layer in incompressible flow are investigated. Detailed comparisons with theoretical and experimental data are used to check the computational scheme as well as the current approach. Severe distortion of the otherwise 2-D boundary layer profile occurs due to the vortex interaction. Results show a decrease in integral layer thicknesses and increase in skin friction where the flow is towards the wall, and the reverse where the flow is away from the wall. Strong secondary vortices, opposite in sense to the original ones, are produced in the boundary layer. Decay of streamwise circulation for co-rotating vortices, is greater than that of counter-rotating vortices. The path of the vortices, as they convect downstream, is qualitatively similar to that of potential theory with modifications due to the presence of induced vortices. Core spreading depends on the strength and placement of the other vortices in the system. The major controlling parameters of vortex strength, spacing, and height are each found to have optimum values for which the magnitude and extent of boundary layer thinning is maximized. Finally, it is found that self-similarity does not always exist for these flows, and streamwise pressure gradients amplify the zero-pressure-gradient results. Dissert Abstr.

N92-33824*# Lockheed Advanced Development Co., Sunland, CA.
STUDIES OF SHOCK/SHOCK INTERACTION ON SMOOTH AND TRANSPIRATION-COOLED HEMISPHERICAL NOSETIPS IN HYPERSONIC FLOW
Michael S. Holden and Kathleen M. Rodriguez Apr. 1992 290 p Prepared in cooperation with Calspan Advanced Technology Center, Buffalo, NY
(Contract NAS1-18570; RTOP 506-40-21-01)
(NASA-CR-189585; NAS 1.26:189585; Rept-7931) Avail: CASI HC A13/MF A03

A program of experimental research and analysis was conducted to examine the heat transfer and pressure distributions in regions of shock/shock interaction over smooth and transpiration-cooled hemispherical noseshapes. The objective of this investigation was to determine whether the large heat transfer generated in regions of shock/shock interaction can be reduced by transpiration cooling. The experimental program was conducted at Mach numbers of 12 to 16 in the Calspan 48-Inch Shock Tunnel. Type 3 and type 4 interaction regions were generated for a range of freestream unit Reynolds numbers to provide shear layer Reynolds numbers from 10 exp 4 to 10 exp 6 to enable laminar and turbulent interaction regions to be studied. Shock/shock interactions were investigated on a smooth hemispherical nosetip and a similar transpiration-cooled nosetip, with the latter configuration being examined for a range of surface blowing rates up to one-third of the freestream mass flux. While the heat transfer measurements on the smooth hemisphere without shock/shock interaction were in good agreement with Fay-Riddell predictions, those on the transpiration-cooled nosetip indicated that its intrinsic roughness caused heating-enhancement factors of over 1.5. In the shock/shock interaction studies on the smooth nosetip, detailed heat transfer and pressure measurements were obtained to map the variation of the distributions with shock-impingement position for a range of type 3 and type 4 interactions. Such sets of measurements were obtained for a range of unit Reynolds numbers and Mach numbers to obtain both laminar and turbulent interactions. The measurements indicated that shear layer transition has a significant influence on the heating rates for the type 4 interaction as well as the anticipated large effects on type 3 interaction heating. In the absence of blowing, the peak heating in the type 3 and type 4 interaction regions, over the transpiration-cooled model, did not appear to be influenced by the model's rough surface characteristics. The studies of the effects of the transpiration cooling on type 3 and type 4 shock/shock interaction regions demonstrated that large surface blowing rates had significant effect on the structure of the flowfield, enlarging the shock layer and moving the region of peak-heating interaction around the body. Author

N92-33845 Northwestern Univ., Evanston, IL.
A NUMERICAL INVESTIGATION OF CONTACT LINE MOTION Ph.D. Thesis
Patrick Joseph Haley, Jr. 1991 136 p
Avail: Univ. Microfilms Order No. DA9128992

The motion of the free surface of a viscous drop is investigated. By using lubrication theory, a model is developed for the motion of the free surface which includes both the effect of slip and the dependence of the contact angle on the slip velocity. The resulting nonlinear partial differential equation is solved in several ways. First, the initial motion of the drop of a nonequilibrium contact is investigated using the method of matched asymptotics. Then a pseudo-spectral method is developed to numerically solve the full nonlinear system. The dependence of the spreading rate of the drop on the various physical parameters and for different slip models is determined. The forced motion of a drop trapped in the vertex of a cone is also studied in the lubrication limit. This problem is solved in several ways. First, the nonlinear lubrication model is solved numerically using a pseudo-spectral method. The lubrication model is also linearized for small forcing amplitudes, and solved numerically with a finite difference method. A small capillary number limit of the nonlinear model is taken, resulting in a nonlinear ordinary differential equation which is solved numerically. Finally, the small capillary number limit is also linearized about a small forcing amplitude and solved analytically. In addition, the viscous and contact line dissipation associated with the motion is determined in all these limits. It is found that in certain limits, the contact line dissipation can dominate the viscous dissipation. Dissert. Abstr.

N92-33847 Alabama Univ., Huntsville.
ON THE MOMENTUM BOUNDARY CONDITION AT SOLID-FLUID INTERFACES Ph.D. Thesis
Gan Mo 1991 143 p
Avail: Univ. Microfilms Order No. DA9129337

The momentum boundary condition in fluid flows at solid walls was investigated both on a macroscopic and molecular length scale. An analytical and a numerical solution for the time-dependent pressure variation in baroeffect experiments were derived. It is

shown that the quasi-steady solution used in earlier work is a good approximation at pressures above 50 mm Hg. Comparison of the solutions with experimental results suggests that the no-slip condition holds at these higher pressures. Monocomponent and binary fluid flows in two-dimensional channels with atomically rough walls were studied with molecular dynamics simulations. Both sinusoidally and randomly roughened walls with various roughness amplitudes, A, were used. It was found that the no-slip condition arises when the molecular mean free path, l, is comparable with A. Therefore, validations of the no-slip conditions should be based on the ratio l/A, rather than the traditionally used ratio of l to the channel or tube diameter, i.e., the Knudsen number. Most interestingly, we found that the no-slip condition in binary flows is established via the superposition of finite slip velocities of the components at the wall. Dissert. Abstr.

N92-33910# Universitaet der Bundeswehr, Hamburg (Germany, F.R.). Fachbereich Maschinenbau.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF UNIFORMLY AND UNEQUALLY SPACED TURBINE CASCADES Ph.D. Thesis [EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNGEN AN GLEICHFOERMIG UND UNGLEICHFOERMIG GETEILTEN TURBINENGITTERN]
Rainer Kurz 1991 175 p In GERMAN
(ETN-92-92056) Avail: CASI HC A08/MF A02

Experimental flow measurements and theoretical computations were carried out. A laser two focus system was used for flow examination. Computation was in good agreement with experimental data. A Euler process was used for the calculations. Experiment and computation showed lower losses for the transonic flow than for the subsonic flow, as long as shock collisions were kept small. A computation process was developed for the exact calculation of subsonic, transonic and sonic flow, for any inequally spaced configuration. It was concluded from computation and measurements, that the interactions between the blades with unequal spacing can be described by the frictionless computation. ESA

N92-33916# Ruhr Univ., Bochum (Germany, F.R.). Fakultaet fuer Maschinenbau.
INFLUENCE OF THE SWIRL PRODUCING CONSTRUCTION IN THE FLOW AND REACTION FIELD OF TURBULENT DIFFUSION FLAMES Ph.D. Thesis [UEBER DEN EINFLUSS DER DRALLERZEUGERKONSTRUKTION AUF DAS STROEMUNGS- UND REAKTIONSFELD TURBULENTER DIFFUSIONSFLAMMEN]
Bernhard Mundus 1990 181 p In GERMAN
(ETN-92-92103) Avail: CASI HC A09/MF A02

Data relating to the influences of single constructions on the aerodynamic properties of turbulent free jet and on the flow and reaction field of free burning turbulent diffusion flames were experimentally obtained and compared. The theoretical swirl number and the swirl number obtained from measuring data were used to describe the swirl power. It was shown that radial positions, and the rates of maximum turbulence degree depend on the swirl producing construction and on the swirl power. Swirl jets and flames were modelized using an integral process based on the analogy between unstationary heat conduction and impulse spreading for free turbulent flows. ESA

N92-33934*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
PREDICTING EQUILIBRIUM STATES WITH REYNOLDS STRESS CLOSURES IN CHANNEL FLOW AND HOMOGENEOUS SHEAR FLOW Final Report
R. Abid and C. G. Speziale Jun. 1992 17 p Submitted for publication
(Contracts NAS1-18605; NAS1-19480; RTOP 505-90-52-01)
(NASA-CR-189669; ICASE-92-28; NAS 1.26:189669) Avail: CASI HC A03/MF A01

Turbulent channel flow and homogeneous shear flow have served as basic building block flows for the testing and calibration of Reynolds stress models. A direct theoretical connection is made between homogeneous shear flow in equilibrium and the log-layer of fully-developed turbulent channel flow. It is shown that if a second-order closure model is calibrated to yield good equilibrium values for homogeneous shear flow it will also yield good results for the log-layer of channel flow provided that the Rotta coefficient is not too far removed from one. Most of the commonly used second-order closure models introduce an ad hoc wall reflection term in order to mask deficient predictions for the log-layer of channel flow that arise either from an inaccurate calibration of homogeneous shear flow or from the use of a Rotta coefficient that is too large. Illustrative model calculations are presented to demonstrate this point which has important implications for turbulence modeling. Author

N92-33968 Old Dominion Univ., Norfolk, VA.
PREDICTION AND CONTROL OF ASYMMETRIC VORTICAL FLOWS AROUND SLENDER BODIES USING NAVIER-STOKES EQUATIONS Ph.D. Thesis
Tin-Chee Wong 1991 245 p
Avail: Univ. Microfilms Order No. DA9130686

Steady and unsteady vortex-dominated flows around slender bodies at high angles of attack are solved by using the unsteady, compressible Navier-Stokes equations. An implicit upwind, finite-volume scheme is used for numerical computations. For supersonic flows past pointed bodies, the locally-conical flow assumption was used. Asymmetric flows past five-degree semi-apex cones using the thin-layer Navier-Stokes equations at different angles of attack, freestream Mach numbers, Reynolds numbers, grid fineness, computational domain size, sources of disturbances, and cross-section shapes were studied. The onset of flow asymmetry occurs when the relative incidence of pointed forebodies exceeds certain critical values. At these critical values of relative incidence, asymmetric flow develops irrespective of the sources of disturbances. The results of unsteady asymmetric flows show that periodic vortex shedding exists at larger angles of attack and it is independent of the numerical schemes used. Passive control of steady and unsteady asymmetric vortical flows around cones using vertical fins and side-strakes were also studied. Side-strikes control of flow asymmetry over a wide range of angles of attack requires shorter strake heights than those of the vertical-fin control and produces higher lift for the same cone. Three-dimensional, incompressible flows past a prolate spheroid and a tangent-ogive cylinder are solved and compared with experimental data for validation of the numerical scheme. Three-dimensional supersonic asymmetric flows around a five degree semi-apex angle circular cone at different angles of attack and Reynolds numbers are presented. Flow asymmetry was obtained using short-duration disturbances. The flow asymmetry becomes stronger as the Reynolds number and angle of attack are increased. The asymmetric solutions show spatial vortex shedding which is qualitatively similar to the temporal vortex shedding of the unsteady locally-conical flow. Dissert. Abstr.

N92-33996# European Space Agency, Paris (France).
EXPERIMENTAL INVESTIGATION OF CROSS-FLOW INSTABILITY IN THE LINEAR AND NON-LINEAR STAGE OF THE TRANSITION REGION Ph.D. Thesis - Karlsruhe Univ. [EXPERIMENTELLE UNTERSUCHUNG DER QUERSTROEMUNGSINSTABILITAET IM LINEAREN UND NICHTLINEAREN BEREICH DES TRANSITIONSGEBIETES]
Bernhard Mueller (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Goettingen, Germany, F.R.) Mar. 1992 154 p Transl. into ENGLISH of Experimentelle Untersuchung der Querstroemungsinstabilitaet im Linearen und Nichtlinearen Bereich des Transitionsgebietes (Goettingen, Fed. Republic of Germany, DLR), Feb. 1990 115 p Original language document was announced as N91-12057
(ESA-TT-1237; DLR-FB-90-09; ETN-92-91963) Avail: CASI HC A08/MF A02; DLR, Wissenschaftliches Berichtswesen, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC

A study on linear and nonlinear stages of the laminar turbulent transition process in three dimensional boundary layers, which are dominated by crossflow instability, using, in particular, hot wire

anemometry, is presented. The experimental model used is closely matched to the assumptions and simplifications made in linear and secondary stability theory, as well as those made in the numerical simulation. The instability modes are studied with respect to wavelength, frequency range, characteristic profile and amplification. The modes display nonlinear saturation in these experiments. At the same time, strong nonlinear interactions are observed between the stationary vortices and traveling waves over the whole of the parameter domain investigated. Furthermore, the modes depend strongly on initial conditions with respect to their amplitudes, wavelengths, frequency ranges and amplification rates. Variations of sweep angle and incident velocity display the trends predicted by linear stablity theory although nonlinear effects continue to dominate. ESA

N92-34003 Washington Univ., Seattle.
EXPERIMENTAL INVESTIGATION OF TURBULENT FLOW THROUGH A CIRCULAR-TO-RECTANGULAR TRANSITION DUCT Ph.D. Thesis
David Owen Davis 1991 259 p
Avail: Univ. Microfilms Order No. DA9131636

Steady, incompressible, turbulent, swirl-free flow through a circular-to-rectangular transition duct has been studied experimentally. The transition duct has an inlet diameter of 20.43 cm, a length-to-diameter ratio of 1.5, and an exit plane aspect ratio of three. The cross-sectional area remains the same at the exit as at the inlet, but varies through the transition section to a maximum value approximately 15 percent above the inlet value. The cross-sectional geometry everywhere along the duct is defined by the equation of a superellipse. Mean and turbulence data were accumulated utilizing pressure and hot-wire instrumentation at five stations along the test section. Data are presented for operating bulk Reynolds numbers of 88,000 and 390,000. Measured quantities include total and static pressure, the three components of the mean velocity vector and the six components of the Reynolds stress tensor. The results show that the curvature of the transition duct walls induces a relatively strong pressure-driven crossflow that produce a contra-rotating vortex pair along the diverging side-walls of the duct. The vortex pair significantly distorts both the mean flow and turbulence field. Local equilibrium conditions at the duct exit, if they exist at all, are confined to a very small region near the wall indicating that care must be taken when using wall functions to predict the flowfield. Analysis of the Reynolds stress tensor at the exit plane shows that streamline curvature and lateral divergence effects distort the non-dimensional turbulence structure parameters. In addition to the transition duct measurements, a hot-wire technique which relies on the sequential use of single rotatable normal and slant-wire probes has been proposed. The technique is applicable for measurement of the total mean velocity vector and the complete Reynolds stress tensor when the primary flow is arbitrarily skewed relative to a plane which lies normal to the probe axis of rotation. Measurement of the mean flow has been verified in fully-developed pipe flow under simulated pitch angles up to +/- 20 degrees. Measurements of the Reynolds stress tensor has been verified for the unskewed condition. Under skewed conditions, systematic deviations of the stress tensor were observed which are attributed to the geometry of the slant-wire probe. A new slant-wire probe is proposed which is designed to reduce, if not eliminate, the observed deficiencies. Dissert. Abstr.

N92-34031# University of Southern California, Los Angeles.
EFFECTS OF CAPILLARY HETEROGENEITY ON VAPOR-LIQUID COUNTERFLOW IN POROUS MEDIA
A. K. Stubos, C. Satik, and Y. C. Yortsos Jun. 1992 24 p
(Contract DE-FG22-90BC-14600)
(DE92-001053; DOE/BC-14600/28) Avail: CASI HC A03/MF A01

Based on a continuum description, the effect of capillary heterogeneity, induced by variation in permeability, on the steady state, countercurrent, vapor-liquid flow in porous media is analyzed. It is shown that the heterogeneity acts as a body force that may enhance or diminish gravity effects on heat pipes. Selection rules that determine the steady states reached in homogeneous, gravity-driven heat pipes are also formulated. It is shown that the 'infinite' two-phase zone may terminate by a substantial change in the permeability somewhere in the medium. The two possible sequences, liquid-liquid dominated-dry, or liquid-vapor dominated-dry find applications in geothermal systems. Finally, it is shown that although weak heterogeneity affects only gravity controlled flows, stronger variations in permeability can give rise to significant capillary effects. DOE

N92-34032# Michigan State Univ.
STUDY OF FLOW PROPERTIES OF WET SOLIDS USING LASER INDUCED PHOTOCHEMICAL ANEMOMETRY
B. Falco Apr. 1992 38 p.
(Contract DE-AC22-88PC-88948)
(DE92-015451) Avail: CASI HC A03/MF A01

A new diagnostic measurement technique is being developed that will enable the investigation of the dynamics of flowing wet solids. The technique involves the use of Laser Induced Photochemical Anemometry (LIPA), enhanced to enable two photochemical species to be excited. It uses laser induced photochromic and photoluminescent molecules to separately tag the two phases for times long enough for them to distort the tagging. Recording the distortions of the tagging caused by the movement of each phase enables us to obtain local characterization of flow properties of both phases of the wet solids at many positions simultaneously across a pipe. DOE

N92-34038 Council for National Academic Awards
FINITE ELEMENT SIMULATION OF VISCOELASTIC FLOW Ph.D. Thesis
Sean James Swarbrick 1990 196 p
Avail: Univ. Microfilms Order No. BRDX93642

A new finite element algorithm for the solution of viscoelastic flow problems is presented. The algorithm uses a decoupled iterative scheme, with element subdivision for the stress field approximations. The viscoelastic fluid models used are differential models of the Maxwell/Oldroyd type. The problem of convergence failure of the iterative scheme is addressed. A number of techniques for increasing the range of convergence are investigated. These include streamline upwinding, variational recovery of velocity gradients, and an interpolation method for the stress field approximation. The effects of these techniques on the non-iterative solutions of the upper-convected Maxwell constitutive equations are also studied. In addition, the convergence properties of the decoupled iterative scheme are investigated. These various investigations are carried out in the context of three particular test problems: the straight parallel-sided channel, the planar abrupt 4:1 contraction, and a 30 degree converging channel. A number of auxiliary progams required for finite element simulations were also developed. These include programs for mesh generation, graphic display, and preparation of numerical integration data. It was demonstrated that useful results in finite element simulation can be obtained even when the available computing resources are very limited. Dissert. Abstr.

N92-34043*# Old Dominion Univ.
INVESTIGATION OF ADVANCING FRONT METHOD FOR GENERATING UNSTRUCTURED GRID Progress Report, period ending 31 May 1992
A. M. Thomas et al Jun. 1992 74 p
(Contract NCC1-68)
(NASA-CR-190902)
Avail: CASI HC A04/MF A01

The advancing front technique is used to generate an unstructured grid about simple aerodynamic geometries. Unstructured grids are generated using VGRID2D and VGRID3D software. Specific problems considered are a NACA 0012 airfoil, a biplane consisting of two NACA 0012 airfoils, a four element airfoil in its landing configuration, and an ONERA M6 wing. Inviscid

time dependent solutions are computed on these geometries using USM3D and the results are compared with standard test results obtained by other investigators. A grid convergence study is conducted for the NACA 0012 airfoil and compared with a structured grid. A structured grid is generated using GRIDGEN software and inviscid solutions computed using CFL3D flow solver. The results obtained by unstructured grid for NACA 0012 airfoil showed an asymmetric distribution of flow quantities, and a fine distribution of grid was required to remove this asymmetry. On the other hand, the structured grid predicted a very symmetric distribution, but when the total number of points were compared to obtain the same results it was seen that structured grid required more grid points. Author

N92-34130# Department of the Navy, Washington, DC.
A METHOD FOR DETERMINING THE VELOCITY OF A THREE-DIMENSIONAL FLUID FLOW OVER A SUBMERGED BODY Patent Application
John R. Grant, inventor (to Navy) 16 Oct. 1991 20 p
(AD-D015266; US-Patent-Appl-SN-777045; Navy-Case-73150)
Avail: CASI HC A03/MF A01

A method for determining the velocity of a three-dimensional fluid flow over a submerged body is provided. A plurality of finite volume cylindrical elements are used to represent the distribution of vorticity at the surface geometry of the body. The vorticity distribution is used to determine the velocity field of the flow according to the Biot-Savart integral which is solved for in a cylindrical coordinate system. GRA

N92-34199*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
INTERSECTING SHOCK-WAVE/TURBULENT BOUNDARY-LAYER INTERACTIONS AT MACH 8.3
M. I. Kussoy (Eloret Corp., Palo Alto, CA.) and K. C. Horstman (Eloret Corp., Palo Alto, CA.) Feb. 1992 48 p
(Contract NCC2-452; RTOP 505-59-40)
(NASA-TM-103909; A-92027; NAS 1.15:103909) Avail: CASI HC A03/MF A01

Experimental data for two three-dimensional intersecting shock-wave/turbulent boundary-layer interaction flows at Mach 8.3 are presented. The test bodies, composed of two sharp fins fastened to a flat-plate test bed, were designed to generate flows with varying degrees of pressure gradient, boundary-layer separation, and turning angle. The data include surface pressure and heat transfer distributions as well as mean flow-field surveys, both in the undisturbed and interaction regimes. The data are presented in a convenient form to be used to validate existing or future computational models of these hypersonic flows. The data are also on a 3.5-inch diskette included with this document, and are available through E-mail. Author

N92-34237*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
DEVELOPMENT OF ITERATIVE TECHNIQUES FOR THE SOLUTION OF UNSTEADY COMPRESSIBLE VISCOUS FLOWS Semiannual Progress Report, 14 Feb. - 13 Aug. 1992
Lakshmi N. Sankar and Duane Hixon Aug. 1992 30 p
(Grant NAG1-1217)
(NASA-CR-190651; NAS 1.26:190651) Avail: CASI HC A03/MF A01

A research effort was initiated at Georgia Tech in February 1991 on the development of efficient techniques for the computation of 2-D and 3-D unsteady compressible flow problems. It was found that in 2-D unsteady viscous flow applications, the generalized minimal residual (GMRES) scheme was able to significantly improve the accuracy and stability characteristics of an existing 2-D ADI (Alternating Direction Implicit) time marching scheme. That is, the GMRES/ADI combination allowed 10 to 20 times larger time steps compared to an ADI scheme. Because the GMRES algorithm requires 5 to 10 times the CPU work compared to the ADI scheme, the combined GMRES/ADI scheme yields a net factor of 2 savings in CPU cost. During the past year, we also experimented with GMRES/multigrid/ADI combination. The purpose of this combination was to compute the low frequency components of the change in the flow properties from one time step to the next on a coarse grid. This strategy reduces the memory requirements of the GMRES method roughly by a factor of 4-8 for steady flow problems. Author

N92-33462# Naples Univ. (Italy). Inst. of Aerodynamics.
FLUID SCIENCE AND TELESCIENCE
Rodolfo Monti *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 37-44 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

N92-33862# National Aerospace Lab., Tokyo (Japan). Space Technology Research Group.
PRELIMINARY REPORT ON FLUID EXPERIMENT BY TR-1A SOUNDING ROCKET
Hisao Azuma *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 131-140 (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N92-33589# Defence Research Establishment, Ottawa (Ontario). Airborne Radar Section.
THE HOLOGRAPHIC NEURAL NETWORK: PERFORMANCE COMPARISON WITH OTHER NEURAL NETWORKS
Robert Klepko Oct. 1991 35 p
(DREO-TN-91-18; CTN-92-60570) Avail: CASI HC A03/MF A01

The artificial neural network shows promise for use in recognition of high resolution radar images of ships. The holographic neural network (HNN) promises a very large data storage capacity and excellent generalization capability, both of which can be achieved with only a few learning trials, unlike most neural networks which require on the order of thousands of learning trials. The HNN is specially designed for pattern association storage, and mathematically realizes the storage and retrieval mechanisms of holograms. The pattern recognition capability of the HNN was studied, and its performance was compared with five other commonly used neural networks: the Adaline, Hamming, bidirectional associative memory, recirculation, and back propagation networks. The patterns used for testing represented artificial high resolution radar images of ships, and appear as a two dimensional topology of peaks with various amplitudes. The performance comparisons showed that the HNN does not perform as well as the other neural networks when using the same test data. However, modification of the data to make it appear more Gaussian distributed, improved the performance of the network. The HNN performs best if the data is completely Gaussian distributed. Author (CISTI)

N92-33614* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SUB-KELVIN RESISTANCE THERMOMETER Patent
Stephen H. Castles, inventor (to NASA) 25 Aug. 1992 8 p
Filed 24 Sep. 1991 Supersedes N92-23460 (30 - 14, p 2378)
(NASA-Case-GSC-13406-1; US-Patent-5,141,334;
US-Patent-Appl-SN-765070; US-Patent-Class-374-178;
US-Patent-Class-374-185; US-Patent-Class-357-28;

US-Patent-Class-338-22SD; US-Patent-Class-338-25; Int-Patent-Class-G01K-7/16; Int-Patent-Class-G01K-7/00) Avail: US Patent and Trademark Office

A device capable of accurate temperature measurement down to 0.01 K of a particular object is discussed. The device is comprised of the following: a heat sink wafer; a first conducting pad bonded near one end of the heat sink wafer; a second conducting pad bonded near the other end of the heat sink wafer; and an oblong doped semiconductor crystal such as germanium. The oblong doped semiconductor crystal has a third conducting pad bonded on its bottom surface with the oblong doped semiconductor crystal bonded to the heat sink wafer by having the fourth conducting pad bonded to the first conducting pad. A wire is bonded between the second and third conducting pads. Current and voltage wires bonded to the first and second conducting pads measure the change in resistance of the oblong doped semiconductor crystal; this indicates the temperature of the object whose temperature is to be measured.

Official Gazette of the U.S. Patent and Trademark Office

N92-33620# Naval Postgraduate School, Monterey, CA.
DESIGN AND FABRICATION OF A FIBER-OPTIC INTERFEROMETRIC ACCELEROMETER SYSTEM M.S. Thesis
Mary Beth A. Chipkevich Mar. 1992 88 p
(AD-A253021) Avail: CASI HC A05/MF A01

Two fiber-optic accelerometer designs are presented. The first accelerometer was constructed using two flexural disks between which is a center spindle. Six uniformly spaced screws fasten the disk assembly to a circular, hollow base housing fiber-optic couplers and splices and providing fiber access. The disk edge is elastically restrained. A flat spirally wound coil of optical fiber is bonded to one surface of each disk. Disk surface strains, caused by acceleration, are detected in a push-pull fashion by fiber coils comprising the legs of a Mach-Zender optical interferometer. This sensor demonstrated an acceleration sensitivity of 2.3 + 0.1 rad/g a bandwidth of 150-475 Hz. The resonance frequency, as 1.22 +/- 0.05 kHz. The second accelerometer design described exploits the benefits of using a disk material having a significantly slower sound speed than aluminum; in general, a slower sound speed increases the acceleration sensitivity and decreases the resonance frequency. One polycarbonate disk with a simply supported edge condition is fastened between an aluminum cap and an aluminum housing base secured with six uniformly spaced screws. One flat fiber coil in each Mach-Zender interferometer leg was bonded to each disk surface. This sensor demonstrated an acceleration sensitivity of 56.9 + 4.0 rad/g over a bandwidth of 30-950 Hz. The resonance frequency was 1.7 + 0.05 kHz. GRA

N92-33696*# Illinois Inst. of Tech., Chicago. Dept. of Mechanical and Aerospace Engineering.
ELECTRO OPTICAL SYSTEM TO MEASURE STRAINS AT HIGH TEMPERATURE Final Report, 16 Jul. 1990 - 31 Dec. 1991
Cesar A. Sciammarella 31 Dec. 1991 58 p
(Grant NAG2-547)
(NASA-CR-190450; NAS 1.26:190450) Avail: CASI HC A04/MF A01

The measurement of strains at temperatures of the order of 1000 C has become a very important field of research. Technological advances in areas such as the analysis of high speed aircraft structures and high efficiency thermal engines require operational temperatures of this order of magnitude. Current techniques for the measurement of strains, such as electrical strain gages, are at the limit of their useful range and new methods need to be developed. Optical techniques are very attractive in this type of application because of their noncontacting nature. Holography is of particular interest because a minimal preparation of the surfaces is required. Optoelectronics holography is specially suited for this type of application, from the point of view of industrial use. There are a number of technical problems that need to be overcome to measure strains using holographic interferometry at high temperatures. Some of these problems are discussed, and solutions are given. A specimen instrumented with high temperature strains gages is used to compare the results of both technologies. Author

N92-33986# Lawrence Livermore National Lab., CA.
GEOMETRY COMPENSATION FOR IMPROVING SPEED AND EFFICIENCY OF SCINTILLATOR-BASED NEUTRON TIME-OF-FLIGHT DETECTORS
R. A. Lerche and T. J. Murphy 11 May 1992 15 p Presented at the 9th Topical Conference on High-Temperature Plasma Diagnostics, Santa Fe, NM, 15-19 Mar. 1992
(Contract W-7405-eng-48)
(DE92-018009; UCRL-JC-109285; CONF-920362-40) Avail: CASI HC A03/MF A01

Scintillator-based neutron detectors record time-of-flight (TOF) information used for estimating ICF plasma temperatures. Nova TOF detectors, which have 1.3-ns resolution and contain 30 cc of scintillator, lack the combination of temporal resolution and sensitivity necessary to measure 1-keV temperatures for deuterium plasmas emitting fewer than 1.5 x 10(exp 9) neutrons. Significant time dispersion is caused by neutron detection-point uncertainty thick scintillators. We describe a geometrical compensation technique by which this dispersion can be substantially reduced while retaining large scintillator volume. We estimate that scintillator/streak camera detectors can achieve 100-ps resolution for 2.45 MeV neutrons, and that scintillator/photomultiplier systems can achieve 150 to 300-ps resolution. DOE

N92-33991# Oxford Univ. (England). Dept. of Engineering Science.
THE IMPLICATIONS OF DIGITAL COMMUNICATION ON SENSOR VALIDATION
Manus Henry and Graeme Wood (Wood, Graeme, Croydon, England) 1992 8 p
(OUEL-1912/92; ETN-92-92064) Avail: CASI HC A02/MF A01

Intelligent sensors and field-bus standards for their intercommunication, synergistic technologies that will greatly enhance process control systems of the future, are addressed. Intelligence in sensors readily supports local sensor validation and fieldbus enables timely communication using standard metrics and status values. Combined, they overcome some of the problems inherent in fault detection based on data from analog sensors. The key features of the new fieldbus standard of relevance to sensor validation are described. Suitable validation metrics and status parameters are introduced and proposed for consideration within the fieldbus standard in the application layer. A demonstration system which performs online validation of Foxboro's Coriolis meter, and which generates the proposed metrics, is outlined. ESA

N92-34106*# Purdue Univ., West Lafayette, IN. Aerospace Sciences Lab.
TESTING OF THE ANEMOMETER CIRCUIT: DATA REPORT Semiannual Status Report, period ending 31 Dec. 1991
Michael J. Moen 15 Mar. 1992 42 p
(Grant NAG1-1201)
(NASA-CR-190623; NAS 1.26:190623) Avail: CASI HC A03/MF A01

The following text discusses results from the electronic step testing and the beginning of velocity step testing in the shock tube. It should be kept in mind that frequency response is always measured as the time from the beginning of the event to the minimum (positive inflection) of the 'bucket' that immediately follows the response. This report is not a complete account of the results from square wave testing. Some data is still in the process of being analyzed and efforts are being made to fit the data to both Freymuth's third order theory and modelled responses from SPICE circuit simulation software. Author

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N92-33279# Optical Society of America, Washington, DC.
OSA PROCEEDINGS OF THE TOPICAL MEETING (5TH) ON SHORT-WAVELENGTH COHERENT RADIATION: GENERATION AND APPLICATIONS, VOLUME 11 Final Report, 1 Jan. - 31 Dec. 1991
Jarus W. Quinn, Philip H. Bucksbaum, and Natale M. Ceglio 22 May 1992 317 p Meeting held in Monterey, CA, 8-10 Apr. 1991
(Grant AF-AFOSR-0176-91)
(AD-A252973; ISBN-1-55752-185-9-Vol-11; AFOSR-92-0512TR-Vol-11) Avail: CASI HC A14/MF A03

The Fifth Topical Meeting on Short-Wavelength Coherent Radiation - Generation and Applications was held in Monterey, California, April 8-10, 1991. This volume contains the papers delivered at the conference, which chronicle the major advances in short-wavelength laser physics and technology. Short-wavelength coherent radiation generation is inextricably linked to high-intensity laser-matter physics, and this meeting had more emphasis on the basic high-field light-matter interaction than ever before. There were three sessions devoted entirely to this subject, with additional papers on high-field technology and physics scattered throughout the meeting. GRA

N92-33397# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
AN 840-Hz Nd:YAG LASER SOURCE OF SODIUM RESONANCE RADIATION Final Report, Jan. 1989 - Mar. 1991
Thomas H. Jeys, Kevin F. Wall, and Jeffrey Korn 11 May 1992 37 p
(Contract F19628-90-C-0002)
(AD-A252908; TR-928; ESD-TR-91-187) Avail: CASI HC A03/MF A01

A 20-W average power laser source of sodium resonance radiation has been developed and delivered to the Air Force Phillips Laboratory to generate a fluorescence spot in the earth's mesospheric sodium layer for atmospheric adaptive optics applications. The sodium resonance radiation was generated by sum-frequency mixing 1.06- and 1.32-UM Nd:YAG laser radiation in a lithium triborate crystal. The pulsed Nd:YAG lasers operated with a repetition rate of 840 Hz and pulse lengths of about 100 us. The sum radiation was resonant with the sodium D 2 transition and generated with an average mixing efficiency of 30 percent. The lasers were mode-locked with a controlled pulse width that provided a spectrally broadened output matched to the 3-GHz Doppler-broadened absorption width of mesospheric sodium. GRA

N92-33549 Department of the Navy, Washington, DC.
LASER DIODE PUMPED MULTIPLE ROD RING LASER ALLOWING COMBINATION OF MULTIPLE PUMP SOURCES Patent
Richard Scheps, inventor (to Navy) 17 Mar. 1992 11 p Filed 7 May 1991
(AD-D015337; US-Patent-5,097,477; US-Patent-Appl-SN-696819; US-Patent-Class-372-94) Avail: US Patent and Trademark Office

A diode pumped ring laser allows for the combination of more pumping mode radiation from pumping laser diodes for pumping at least one gain element which is simultaneously end pumped in two longitudinal resonator axes that intersect in a focused waist at a bounce point. Each gain element and associated mirrors are disposed to direct a hemispherical shaped resonator mode to a focus (waist) in each gain element where the resonator mode is reflected from the waist and diverges away to form two cone-shaped active volumes in each gain element. Locating and orienting pumping diodes to longitudinally end pump the resonator modes with their pumping radiation to have a nearly perfect overlap of the resonator mode throughout the length of the active volumes in each gain element assures a more efficient, higher power end pumping of the gain elements. Appropriately arranging gain elements and mirrors directs pumping mode radiation to enter an exterior face and leave through an interior face of each gain element. Resonator mode radiation enters and leaves through the interior face of each gain element at a large enough angle, such as the Brewster's angle, which, in addition to allowing the pumping of both active volumes within each gain element rod, also provides for a high degree of linear polarization of the resonant mode and promotes stable unidirectional operation of the ring laser. GRA

N92-33573 Department of the Navy, Washington, DC.
LASER BEAM STOP Patent
Richard B. Thompson, inventor (to Navy) 28 Jan. 1992 4 p Filed 31 May 1990
(AD-D015317; US-Patent-5,083,852; US-Patent-Appl-SN-531422; US-Patent-Class-359-886) Avail: US Patent and Trademark Office

A laser beam stop is constructed having a uniquely designed cell filled with a solution or suspension of an absorbing species chosen to absorb the wavelength of light emitted by the laser. The position and strength of the laser beam are indicated by the strength and depth of penetration of the fluorescence excited by the laser. GRA

N92-33574 Department of the Navy, Washington, DC.
ERBIUM-DOPED FLUOROZIRCONATE FIBER LASER PUMPED BY A DIODE LASER SOURCE Patent
Leon Esterowitz, inventor (to Navy) and Roger E. Allen, inventor (to Navy) 28 Jan. 1992 8 p Filed 2 Jul. 1990
(AD-D015318; US-Patent-5,084,880; US-Patent-Appl-SN-546818; US-Patent-Class-376-6) Avail: US Patent and Trademark Office

A room temperature laser system for producing a CW laser emission at substantially 2.7 microns is disclosed. In a preferred embodiment, the laser system comprises a laser diode source for producing a CW pump beam at a preselected wavelength and a fiber laser doped with erbium activator ions to produce an output CW laser emission at a wavelength in the range of 2.71-2.78 microns when the fiber laser is pumped by the CW pump beam. GRA

N92-33576 Department of the Navy, Washington, DC.
ROOM-TEMPERATURE, FLASHPUMPED, 2.09 MICRON SOLID STATE LASER Patent
Leon Esterowitz, inventor (to Navy) and Gregory J. Quarles, inventor (to Navy) 11 Feb. 1992 8 p Filed 30 Apr. 1990
(AD-D015320; US-Patent-5,088,103; US-Patent-Appl-SN-516943; US-Patent-Class-372-68) Avail: US Patent and Trademark Office

A room temperature solid state laser for producing a laser emission at a wavelength of substantially 2.09 microns is disclosed. In a preferred embodiment, the laser includes a laser cavity defined by first and second reflective elements opposing each other on a common axis to form a path there between; a laser crystal disposed in the laser cavity, the laser crystal having a host material capable of accepting Cr(3+) sensitizer ions, TM(3+) sensitizer ions and Ho(3+) activator ions; an amount of Cr(3+) sensitizer ions between about 0.3 percent and about 2 percent dispersed within the hostmaterial; an amount of TM(3+) sensitizer ions between about 3 percent and about 12 percent dispersed within the host material; and an amount of Ho(3+) activator ions between about 0.1 percent and about 0.7 percent dispersed within the host material; and a flashlamp and a means for exciting the laser crystal to produce a laser emission at substantially 2.09 microns with a slope efficiency of at least 4 percent, and preferably of at least 5 percent. GRA

N92-33626# National Inst. for Fusion Science, Nagoya (Japan).
SUPERPOSED-LASER ELECTRON ACCELERATION
T. Maruyama (Nagaoka Technological Univ., Japan) and S. Kawata (Nagaoka Technological Univ., Japan) Feb. 1992 21 p Submitted for publication
(NIFS-133) Avail: CASI HC A03/MF A01

A new mechanism is proposed for electron acceleration by using two superposed laser beams in vacuum. In this mechanism an electron is accelerated by the longitudinal component of the wave electric field in the overlapped region of two laser beams.

Single-particle computations and analytical works are performed in order to demonstrate the viability. These results show that the electron can be accelerated well in the proposed mechanism.
Author

N92-33988# Lawrence Livermore National Lab., CA.
HIGH BRILLIANCE, FEMTOSECOND X RAY SOURCES WITH FEL ASSIST
W. A. Barletta, R. Bonifacio, and P. Pierini (Milan Univ., Italy) Apr. 1992 15 p Presented at the 4th Generation Light Sources Workshop, Stanford, CA, 24-27 Feb. 1992
(Contract W-7405-eng-48)
(DE92-018063; UCRL-JC-110289; CONF-9202111-6) Avail: CASI HC A03/MF A01

We describe EFSX, a means of using currently available RF-linac technology to produce multi-kiloampere pulses of 100 to 300 fs duration for use in the generation of extremely short bursts of x rays. The key technical concept, the use of the free electron laser as a bunching mechanism, was proposed for confirmation in the ELFA experiment. By operating the FEL buncher in the strong super-radiant regime, one should be able to shorten the x-ray pulses to 10-30 fs duration. As laser photo-cathode sources of beams evolve to yield ever better emittances, the EFSX could be easily retrofitted to furnish the drive beam for an efficient x ray free electron laser. Potential debunching effects are discussed. Finally, we describe a low energy test experiment. DOE

N92-33990# California Univ., Los Angeles. Dept. of Physics.
LASER ACCELERATION AND NONLINEAR BEAM DYNAMICS
C. Pellegrini 1991 5 p
(Contract DE-FG03-90ER-40565)
(DE92-018703; DOE/ER-40565/1) Avail: CASI HC A01/MF A01

This research contract covers the period April 1990, September 1991. The work to be done under the contract was theoretical research in the areas of nonlinear beam dynamics and laser acceleration We discuss the motivation for this work and the results obtained. DOE

N92-34135# Department of the Navy, Washington, DC.
SUPPRESSION OF RELAXATION OSCILLATIONS IN FLASHPUMPED, TWO-MICRON, TUNABLE SOLID STATE LASERS Patent Application
Leon Esterowitz, inventor (to Navy) and Joseph F. Pinto, inventor (to Navy) 31 Jan. 1992 44 p
(AD-D015283; US-Patent-Appl-SN-829145) Avail: CASI HC A03/MF A01

A flashpumped, tunable, two-micron, solid state laser is disclosed in which laser spiking is suppressed. The solid state laser comprises: (1) a laser cavity defined by a first reflective element and an output coupler reflective element to form a reflective path between a laser crystal disposed in the laser cavity (the laser crystal having a host material doped with preselected activator ions sufficient to produce a pulse of laser emission at a desired laser transition wavelength in a range between about 1.9 microns and about 2.1 microns when the crystal is optically excited to produce the laser emission); (2) a pulsed flashlamp for optically exciting the laser crystal to produce a pulse of laser emission at the desired laser transition wavelength; (3) a tuner disposed in the laser cavity between the laser crystal and one of the reflective elements for tuning the laser emission to the desired laser transition wavelength in the range of wavelengths between about 1.9 microns and about 2.1 microns; (4) optical plates oriented at Brewster's angle in the reflective path for suppressing oscillation of undesired wavelengths within the laser cavity; and (5) a nonlinear crystal disposed in the reflective path to enable the laser to emit through the output coupler reflective element a smooth, long pulse of laser emission without spiking at the desired laser transition wavelength. GRA

N92-34137 Department of the Navy, Washington, DC.
LASER DIODE-PUMPED TUNABLE SOLID STATE LASER Patent
Richard Scheps, inventor (to Navy) 18 Feb. 1992 8 p Filed 10 Jan. 1991
(AD-D015288; US-Patent-5,090,019; US-Patent-Appl-SN-639645; US-Patent-Class-372-39) Avail: CASI HC A02/MF A01

A low threshold resonator for an alexandrite laser receives a 680 nm pumping beam from at least one laser pump to provide alexandrite laser emission at around 751 nm. An alexandrite crystal or rod receives the 680 nm beam and has an exterior face provided with a dichroic coating highly transmissive to the 680 nm beam and highly reflective to the 751 nm emission and has an interior face provided with an AR coating antireflective to the 751 nm emission. A mirror, provided with a HR coating that is highly reflective to the 751 nm emission, has an appropriate radius of curvature and is appropriately spaced from the exterior face of the alexandrite rod to focus reflected 751 nm emission in a resonator mode on the exterior face of the alexandrite rod to assure low threshold pumping. The mirror has a radius of curvature which is the same as the spacing between the exterior face of the alexandrite rod and the mirror to focus the reflected emission in the resonator mode in a spot size on the exterior face. A lens is disposed to receive the pumping beam to focus it on the spot size on the exterior face of the alexandrite rod. The lens, the alexandrite rod, and the mirror are appropriately configured and predeterminably spaced with respect to each other to assure that mode matching of the lens expands at exactly the same rate as the resonator mode to assure low threshold pumping. GRA

N92-34152# European Space Agency, Paris (France).
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF TRANSVERSE FLOW AERODYNAMIC WINDOWS FOR HIGH POWER LASERS Ph.D. Thesis - Stuttgart Univ.
[ANALYTISCHE UND EXPERIMENTELLE UNTERSUCHUNG TRANSVERSAL GESTROEMTER AERODYNAMISCHER FENSTER FUER HOCHLEISTUNGSLASER]
Eberhard Wildermuth (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart, Germany, F.R.) Mar. 1992 246 p Transl. into GERMAN of Analytische und Experimentelle Untersuchung Transversal Gestroemter Aerodynamischer Fenster fuer Hochleistungslaser (Stuttgart, Fed. Republic of Germany, DLR), Aug. 1990 194 p Original language document was announced as N91-16367
(ESA-TT-1251; DLR-FB-90-33; ETN-92-91965) Avail: CASI HC A11/MF A03; DLR, Wissenschaftliches Berichtswesen, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC

Various concepts of transverse flow aerodynamic windows are presented for use as the output element in CO2 high power lasers. A jet of gas transverse to the optical axis screens the laser cavity against the surrounding atmosphere. More than one concept was investigated in order to optimize the optical quality and minimize the mass flow through the aerodynamic window. The particular layout for each concept and the experiments used for investigating the optical and fluid mechanics properties indicate the extent to which each of them can be employed. The design and the experimental operation of a prototype used in combination with a 5 kW CO2 laser and the different ways of achieving laser beam output through an aerodynamic window are discussed. Beam quality calculations are compared with experimental results. ESA

N92-34194# Texas Univ., Austin. Microelectronics Research Center.
BISTABLE VERTICAL CAVITY SURFACE EMITTING LASERS Annual Report
Dennis G. Deppe 30 Jun. 1992 4 p
(Contract N00014-91-J-1952)
(AD-A253123) Avail: CASI HC A01/MF A01

This work takes both theoretical and experimental paths in the study of how optical microcavities influence light emission from semiconductors. Computer simulation is used to guide the development of physical models for spontaneous and stimulated emission under the cavity influence, with experimental demonstrations used as tests of the models and to gain further insight. Initial experimental device results have demonstrated that bistability can be achieved in the VCSEL, but the source of the

bistability has not been clearly defined as of yet in our experimental work. We have demonstrated the usefulness of our particular device design, as evidenced in our optical switching to achieve optical memory, described in Publications 1 and 6. An intriguing possibility for the source of the bistability lies in the details of an optically thin gain region and its placement in the Fabry-Perot microcavity. The bistability then might arise due to changes in the field overlap with the gain region when the device bias is increased from below lasing to above threshold. GRA

N92-34225*# Case Western Reserve Univ., Cleveland, OH.
DEVELOPMENT OF A VERSATILE LASER LIGHT SCATTERING INSTRUMENT Final Technical Report
William V. Meyer and Rafat R. Ansari Aug. 1992 17 p
(Contract NCC3-74)
(NASA-CR-190739; NAS 1.26:190739) Avail: CASI HC A03/MF A01

NASA Lewis Research Center is providing and coordinating the technology for placing a compact Laser Light Scattering (LLS) instrument in a microgravity environment. This will be accomplished by defining and assessing user requirements for microgravity experiments, coordinating needed technological developments, and filling technical gaps. This effort is striving to brassboard and evaluate a miniature multi-angle LLS instrument. The progress of the program is reported. Author

N92-33332*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
RF FEL FOR POWER BEAMING
Robert Burke *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 386-405
(For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33364*# Shanghai Observatory (China).
A HYDROGEN MASER WITH CAVITY AUTO-TUNER FOR TIMEKEEPING
C. F. Lin, J. W. He, and Z. C. Zhai *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 161-16 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

N92-33365*# Shanghai Observatory (China).
A KIND OF SMALL HYDROGEN MASER FOR TIME-KEEPING
Z. C. Zhai, C. F. Lin, J. W. He, H. X. Huang, and J. F. Lu *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 169-17 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

N92-33376*# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
A CORRELATIONAL ANALYSIS OF THE EFFECTS OF CHANGING ENVIRONMENTAL CONDITIONS ON THE NR ATOMIC HYDROGEN MASER
Richard A. Dragonette and Joseph J. Suter *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 287-29 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N92-33498# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.
ACTIVE CONTROL OF COMPRESSOR SURGE AND STALL Progress Report, 1991-1992
C. Boussios, A. H. Epstein, E. M. Greitzer, G. Hendricks, and J. Paduano 1992 10 p Sponsored by Naval Ocean Systems Center
(AD-A252771) Avail: CASI HC A02/MF A01

Having demonstrated in previous years the ability to model, identify, and control rotating stall, our research has concentrated in the past year on refinements and extensions to the compressor modeling developed for active control research. The areas in which progress has been made are: (1) refinement of the basic fluid mechanics based on identification results, (2) understanding the effects of distortion on wave detection, and (3) using the nonlinear form of the rotating stall model to simulate short-circumferential extent waves. Three-stage actively stabilized compressor experiments supported this work, and further verified that rotating stall stabilization is a viable concept. GRA

N92-33538# Cranfield Inst. of Tech., Bedford (England). School of Mechanical Engineering.
RADIAL INFLOW TURBINE STUDY Interim Report No. 7
S. Hamid and R. L. Elder Mar. 1992 11 p
(Contract DAJA45-89-C-0006)
(AD-A252783; R/D-5824-AN-01) Avail: CASI HC A03/MF A01

The radial inflow turbine is a primary component used both in small gas turbines and turbochargers. Better understanding of the flow processes occurring within the small passages of the machine could well result in the improved design of units. As most of the detailed aerodynamics is still ill-defined, a joint research project with the objective of improving our understanding has been instigated by Cranfield, the US Army and Turbomach (San Diego). This document gives the seventh report on the project and describes progress and measurements taken. GRA

N92-33555# Los Alamos National Lab., NM.
MICROWAVE JOINING OF SILICON CARBIDE USING SEVERAL DIFFERENT APPROACHES
I. Ahmad (Technology Assessment and Transfer, Inc., Annapolis, MD.), R. Silberglitt (Technology Assessment and Transfer, Inc., Annapolis, MD.), W. M. Black (George Mason Univ., Fairfax, VA.), H. S. Saadaldin (George Mason Univ., Fairfax, VA.), and J. D. Katz 1992 7 p Presented at the Material Research Society Spring Meeting, San Francisco, CA, 27 Apr. - 2 May 1992
(Contract W-7405-eng-36)
(DE92-015204; LA-UR-92-1496; CONF-920402-27) Avail: CASI HC A02/MF A01

Microwave joining of sintered silicon carbide, both to itself and reaction bonded silicon carbide, has been accomplished in a single-mode rectangular resonant cavity. Several approaches using different interlayer materials were employed to join sintered silicon carbide. Effective joining of reaction bonded silicon carbide to itself and sintered silicon carbide was accomplished without the use of any interlayer material in the single-mode resonant cavity as well as in a multi-mode oven. Specimens cut from 3/8" diameter-rods were joined in the single-mode cavity, whereas a variety of arbitrary shapes and larger specimens (of reaction bonded silicon carbide) were joined in the multi-mode oven. DOE

N92-33616* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
PAGE TURNING SYSTEM Patent
James J. Kerley, inventor (to NASA) and Wayne D. Eklund, inventor (to NASA) 22 Sep. 1992 9 p Filed 24 Dec. 1991 Supersedes N92-24059 (30 - 14, p 2386)
(NASA-Case-GSC-13415-1; US-Patent-5,149,046; US-Patent-Appl-SN-812932; US-Patent-Class-248-453; US-Patent-Class-248-455; US-Patent-Class-248-463; Int-Patent-Class-A47B-97/04) Avail: US Patent and Trademark Office

A device for holding reading materials for use by readers without arm mobility is presented. The device is adapted to hold the reading materials in position for reading with the pages displayed to enable turning by use of a rubber tipped stick that is held in the mouth and has a pair of rectangular frames. The frames are for holding and positioning the reading materials opened in reading posture with the pages displayed at a substantially

unobstructed sighting position for reading. The pair of rectangular frames are connected to one another by a hinge so the angle between the frames may be varied thereby varying the inclination of the reading material. A pair of bent spring mounted wires for holding opposing pages of the reading material open for reading without substantial visual interference of the pages is mounted to the base. The wires are also adjustable to the thickness of the reading material and have a variable friction adjustment. This enables the force of the wires against the pages to be varied and permits the reader to manipulate the pages with the stick.

Author

N92-33634* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

FLEXIBLE ROBOTIC ARM Patent

Israel A. Moya, inventor (to NASA) and Philip A. Studer, inventor (to NASA) 1 Sep. 1992 7 p Filed 4 Sep. 1991 Supersedes N92-24060 (30 - 14, p 2386)

(NASA-Case-GSC-13161-1; US-Patent-5,142,932; US-Patent-Appl-SN-754828; US-Patent-Class-74-479; US-Patent-Class-310-82; US-Patent-Class-310-112; US-Patent-Class-901-9; US-Patent-Class-901-23; US-Patent-Class-901-28; Int-Patent-Class-B25J-17/00) Avail: US Patent and Trademark Office

A plurality of identical modules are serially connected together with each module including a base plate and a top plate interconnected by a ball joint assembly so that the top plate is adapted to pivotally nutate around the base plate to describe a cone in space. An array of twenty-four electromagnets, sequentially energized in sets of three, are arranged in a ring around the periphery of the base plate. Selective energization of the eight sets of electromagnets causes the rim of the top plate to be magnetically attracted to the energized electromagnets. The tilt of the top pivot plate is detected and controlled over a range of 360 degrees, thus permitting a series string of modules to assume any desired elongated configuration.

Official Gazette of the U.S. Patent and Trademark Office

N92-33804# Technische Univ., Berlin (Germany, F.R.). Fachbereich Verkehrswesen.

IMPROVEMENT OF THE DIRECTIONAL STABILITY OF PASSENGER CAR TRAILER COUPLINGS WITH ACTIVELY CONTROLLED STEERING Ph.D. Thesis [VERBESSERUNG DER FAHRSTABILITAET VON PKW-GESPANNEN MIT AKTIV GESTEUERTEN LENKUNGEN]

Jens Desens 1991 75 p In GERMAN

(ETN-92-92134) Avail: CASI HC A04/MF A01

The stabilization of pendulum oscillations of passenger car trailer couplings, using active steering, was examined. A linear model of the couplings was presented. Each axle was provided with a controller. The controllers were optimized, with regard to necessary sensors, in order to minimize costs. The rear and the front axles were provided with a control unit in order to compute the potential prevailing in the active steering of several axles. It was shown that the passenger car rear axle was the most suitable for coupling stabilization. The experiment was simulated, using a complex coupling model. The developed controller allowed the passenger car trailer to be driven at a speed higher than 150 km per hour.

ESA

N92-33869 Michigan State Univ., East Lansing.

NONLINEAR DYNAMICS OF SHAFTS ROTATING AT NONCONSTANT SPIN RATES Ph.D. Thesis

Chih-Kao Ma 1991 241 p

Avail: Univ. Microfilms Order No. DA9129475

This study investigates both theoretically and experimentally the effects of nonconstant spin rates upon the nonlinear dynamics of a shaft rotating about its longitudinal axis. It is assumed that the spin rate can be written as the sum of a steady-state part of a small periodic fluctuation. In particular, the spin rate is taken to be of the form Omega = Omega sub s + epsilon(Omega sub A)sin(omega(tau)). The fluctuating component gives rise to time dependent coefficients in the system's governing equations and thus, a variety of resonant responses result which depend on the relationship between Omega sub s, epsilon(Omega sub A), omega and the system's natural frequencies omega sub 1 and omega sub 2. Both pre-buckled and post-buckled behavior of two main classifications, a cantilevered beam and a simply supported shaft, are considered in this study. The theoretical investigation involves obtaining approximate solutions to the governing nonlinear differential equations by application of the method of multiple scales. A variety of resonant conditions, including parametric resonance, main resonance, subharmonic resonance, and combination resonance, are investigated in detail. The influence which an additional constraint of omega sub 2 approximately = omega sub 1 has on the pre-buckled and post-buckled behavior of the simply supported shaft is of predominant interest. Numerous numerical examples of these steady-state solutions are presented which highlight a variety of phenomena such as nonexistence of steady-state motions, coexistence of steady-state motions and amplitude modulate motions, and re-stabilization of trivial solutions. For the cantilevered beam case, Melnikov's method is used to show that chaotic motions may exist. Results from an experimental study on a spinning cantilevered beam are used to confirm the presence of a variety of phenomena which were theoretically predicted to exist. Finally, numerical simulations are employed to check a number of the approximate solutions obtained by the method of multiple scales. They are also used to investigate non-steady-state responses.

Dissert. Abstr.

N92-33902 Maryland Univ., College Park.

KINEMATIC SYNTHESIS OF BEVEL-GEAR-TYPE ROBOTIC WRIST MECHANISMS Ph.D. Thesis

Chen-Chou Lin 1991 175 p

Avail: Univ. Microfilms Order No. DA9133117

Bevel-gear-type robotic wrist mechanisms are commonly used in industry. The reasons for their popularity are that they are compact, light-weight, and relatively inexpensive. However, there are singularities in their workspace, which substantially degrade their manipulative performance. The objective of this research is to develop an atlas of three-degree-of-freedom bevel-gear-type wrist mechanisms, and through dimensional synthesis to improve their kinematic performance. The dissertation contains two major parts: the first is structural analysis and synthesis, the other is kinematic analysis and dimensional synthesis. To synthesize the kinematic structures of bevel-gear-type wrist mechanisms, the kinematic structures are separated from their functional considerations. All kinematic structures which satisfy the mobility condition are enumerated in an unbiased, systematic manner. Then the bevel-gear-type wrist mechanisms are identified by applying the functional requirements. Structural analysis shows that a three-degree-of-freedom wrist mechanism usually consists of non-fractionated, two degree-of-freedom epicyclic gear train jointed with the base link. Therefore, the structural synthesis can be simplified into a problem of examining the atlas of non-fractionated, two-degree-of-freedom epicyclic gear trains. The resulting bevel-gear-type wrist mechanism has been categorized and evaluated. It is shown that three-degree-of-freedom, four-jointed wrist mechanisms are promising for further improving the kinematic performance. It is found that a spherical planetary gear train is necessarily imbedded in a three-degree-of-freedom, four-jointed wrist mechanism. Therefore, to study the workspace and singularity problems of three-degree-of-freedom four-jointed spherical wrist mechanisms, we have to study the trajectories of spherical planetary gear trains. The parametric equations of the trajectories and some useful geometric properties for the analysis and synthesis of workplace are derived. The workspace boundary equations can be derived via both geometric consideration and Jacobian analysis. The workspace is divided by inner and outer boundaries into regions of accessibility of zero, two, and four. The design criteria of full workspace and a maximum four-root region are established. Finally, a design is suggested based on its kinematic performance.

Dissert. Abstr.

N92-33917 Purdue Univ., West Lafayette, IN.
CHARACTERIZATION OF THE STABILITY OF A FLEXIBLE FIXTURE THAT USES THREE-POINT FRICTIONAL CONSTRAINT FOR ASSEMBLY APPLICATIONS Ph.D. Thesis
Kenneth John Linder 1991 145 p
Avail: Univ. Microfilms Order No. DA9132470

Flexible assembly systems require flexible fixtures to constrain parts in a stable fashion in order to perform assembly operations. A fixtured part is either unstable or stable depending on whether or not it moves when the clamping force is applied. The frictional constraint is well suited for fixturing within the assembly environment; however, methods of predicting the stability of parts under frictional constraint are few. This dissertation gives a systematic strategy that uses graphical techniques to characterize the stability of parts fixtured under a particular type of three-point frictional constraint. This stability characterization scheme can aid a fixture designer in the synthesis of fixture configurations. The three inputs into this method are the location of the center of gravity of the part and the geometrical and frictional properties of the fixturing system. No information about the applied clamping force is necessary for the method to characterize stability. The method first determines if it is possible that static equilibrium will not occur when the clamping force is applied. If this possibility exists, then corresponding kinematically possible motions are determined and are tested for consistency with dynamics to determine if any of them are a possible unstable mode. Finally, the method classifies a part into one of three classifications: stable, unstable, or indeterminate. If is is determined that there are no possible unstable modes then the part is stable. But if it is determined that the part will move in an unstable motion then it is unstable. If it is discovered that the part has possible unstable motions and yet can also be stable under either a purely two-point frictional constraint or the three-point frictional constraint, then it is indeterminate. Several examples of using the method are given. Unlike parts within the stable and unstable classifications, the stability of indeterminate parts is significantly influenced by the following: the deformation of the part, the solution of the dynamic equations of motion of the part, and the surface friction upon the part. Since the influences of deformation and surface friction are, using the current knowledge in the literature, indeterminate in themselves, the cause indeterminacies of stability to exist. In spite of these stability indeterminacies, the method can determine all possible unstable motions of both unstable and indeterminate parts. Dissert. Abstr.

N92-33961 Maryland Univ., College Park.
TENDON-DRIVEN MANIPULATORS: ANALYSIS, SYNTHESIS, AND CONTROL Ph.D. Thesis
Jyh-Jone Lee 1991 149 p
Avail: Univ. Microfilms Order No. DA9133113

As the development of light-weight, small volume, and versatile manipulators has grown in the field of robotics, the need for more efficient and relevant power transmission systems in the manipulators has become increasingly apparent. It is clear that the advent of efficient, low friction, and backlash-free actuation systems promises to provide significant gains in manipulator performance. Tendon transmission has been widely used to actuate small volume and light-weight articulated manipulators, such as dextrous mechanical hands, for it permits actuators to be installed remotely from the end-effector, thus reducing the bulk and inertia of the manipulator system. Current research on such actuation systems is accomplished on the basis of specialized designs. The lack of systematic approaches has limited our scope in realizing performance of such transmission systems. Therefore, when associated with systematic methodologies, the study of tendon-driven manipulators promises to be of major importance in the field of robotics. This dissertation is concerned with four issues to enhance our use and understanding of tendon-driven manipulators. First, a systematic approach for the kinematics analysis of tendon-driven manipulators is established. A graph is used to represent the kinematic structure of tendon-driven manipulators. It is shown that the kinematic structure of tendon-driven manipulators is in every way similar to that of epicyclic gear trains. The fundamental circuit equation developed for the kinematic analysis of epicyclic gear trains can thus be applied to this type of mechanism. The displacement equation governing joint angle space and tendon space can easily be obtained. Secondly, the concept of structural isomorphism and the structural characteristics of tendon-driven manipulators are investigated. Based on the explored properties, a methodology for the enumeration of tendon-driven manipulators is developed. By applying the methodology, a class of kinematic structures having pseudo-triangular structure matrix is enumerated. Thirdly, a method for assessing the kinematic/static performance of tendon-driven manipulators is developed. Transmission ellipsoids of the manipulators are investigated. A criterion for differentiating force transmission characteristics and a procedure for identifying least maximum-tendon-force are established. Dissert. Abstr.

N92-33967 Stevens Inst. of Tech., Hoboken, NJ.
FEEDBACK CONTROL OF HIGH-SPEED FLEXIBLE MECHANISMS: THEORY AND EXPERIMENT Ph.D. Thesis
Ruey-Yue Lin 1991 145 p
Avail: Univ. Microfilms Order No. DA9133222

A systematic approach to the active control of the vibratory response of a high speed flexible system is proposed. It has been known that a lightly damped flexible mechanism experiences an oscillatory response at certain speeds. This behavior causes inaccuracies in position and fatigue failure. The objective of this research is to damp the response of the flexible system by means of an active control system. Finite element analysis is employed to derive the equations of motion for the system. Modal analysis is used to obtain the most critical modes. A state variable method is applied to establish a feedback control system which takes into account the variations of the system matrix, input matrix, and output matrix. Structural controllability and Kalman's principle of duality are employed to test the properties of controllability and observability. The feedback controller and observer are constructed by way of a Lyapunov function and Luenberger observer. Stability of unmodeled modes is examined. Two numerical algorithms are presented. One is a direct integration, the other a closed-form solution. The closed-form solution is developed by means of discrete approximations and a periodicity condition and then solved by frontal method. A set of experiments is performed to validate the control strategy. A hybrid compensation system is employed to perform signal processing, implement the control law, and model the observer. Computer simulations and experimental results are both presented. Dissert. Abstr.

N92-33998 City Univ., London (England).
QUANTITATIVE MODEL VALIDATION OF MANIPULATIVE ROBOT SYSTEMS Ph.D. Thesis
Iman Herwidiana Kartowisastro 1991 279 p
Avail: Univ. Microfilms Order No. BRDX94469

This thesis is concerned with applying the distortion quantitative validation technique to a robot manipulative system with revolute joints. Using the distortion technique to validate a model quantitatively, the model parameter uncertainties are taken into account in assessing the faithfulness of the model and this approach is relatively more objective than the commonly visual comparison method. The industrial robot is represented by the TQ MA2000 robot arm. Details of the mathematical derivation of the distortion technique are given which explains the required distortion of the constant parameters within the model and the assessment of model adequacy. Due to the complexity of a robot model, only the first three degrees of freedom are considered where all links are assumed rigid. The modelling involves the Newton-Euler approach to obtain the dynamics model, and the Denavit-Hartenberg convention is used throughout the work. The conventional feedback control system is used in developing the model. The system behavior to parameter changes is investigated as some parameters are redundant. This work is important so that the most important parameters to be distorted can be selected and this leads to a new term called the fundamental parameters. The transfer function approach has been chosen to validate an industrial robot quantitatively against the measured data due to its

practicality. Initially, the assessment of the model fidelity criterion indicated that the model was not capable of explaining the transient record in term of the model parameter uncertainties. Further investigations led to significant improvements of the model and better understanding of the model properties. After several improvements in the model, the fidelity criterion obtained was almost satisfied. Although the fidelity criterion is slightly less than unity, it has been shown that the distortion technique can be applied in a robot manipulative system. Using the validated model, the importance of friction terms in the model was highlighted with the aid of the partition control technique. It was also shown that the conventional feedback control scheme was insufficient for a robot manipulative system due to high nonlinearity which was inherent in the robot manipulator. Dissert. Abstr.

N92-34018# Technische Univ., Berlin (Germany, F.R.). Inst. fuer Luft- und Raumfahrt.

DYNAMIC CALCULATION OF RAIL VEHICLES: A CONCEPT FOR THE APPLICATION OF THE PROCESS OF STATISTICAL LINEARIZATION IN THE MANY BODY PROGRAM SYSTEM MEDYNA [LAUFDYNAMISCHE BERECHNUNG VON SCHIENENFAHRZEUGEN: EIN KONZEPT ZUM EINBAU DES VERFAHRENS DER STATISTISCHEN LINEARISIERUNG IN DAS MKS-PROGRAMMSYSTEM MEDYNA]

A. Renger (Lokomotivbau-Elektrotechnische Werke, Henningsdorf, Germany, F.R.) 1991 192 p In GERMAN
(ILR-Mitt-264(1991); ETN-92-91914) Avail: CASI HC A09/MF A02

A substructure for the wheel sets is developed. The problem of relating the substructures to the general body system by the calculation of statistical linearized, generalized force vectors for various linear and nonlinear joining elements is solved. Nonlinear spring and damper connections, Coulomb translation friction dampers, and Coulomb rotation friction dampers are covered. Statistically linearized dynamic connecting elements are modelized. It is shown how the general differential equation system is to be constructed. The iteration process for the determination of the free linearization parameter is presented. ESA

N92-34101# Sandia National Labs., Albuquerque, NM.

SMALL THREADED CONNECTIONS: RECOMMENDATIONS FOR DESIGN AND TESTING

R. T. Reese, F. Cericola, and T. L. Ernest Jul. 1992 23 p
(Contract DE-AC04-76DP-00789)
(DE92-017742; SAND-91-1047) Avail: CASI HC A03/MF A01

This report describes how small threaded fasteners should be used in threaded connections. Considerable test experience gives many insights into how small threaded fasteners should be used. The test evidence is summarized. The test methods and procedures are described for tension tests to determine strength and ductility. Small threaded fasteners have been used successfully for many years in Sandia applications. Problems have been encountered in manufacturing parts using three fasteners. This report addresses these manufacturing problems and offers recommendations in five areas: (1) design and layout of threaded connections; (2) required depths for tapped holes; (3) characteristics of mating (clamped) surfaces; (4) tensile strength testing procedures and lengths of engagement needed to achieve the full tensile strength of these small fasteners; and (5) installation procedures. DOE

N92-34173* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

LINEAR MASS ACTUATOR Patent

Sidney E. Holloway, III, inventor (to NASA), Edward A. Crossley, Jr., inventor (to NASA), Irby W. Jones, inventor (to NASA), James B. Miller, inventor (to NASA), C. Calvin Davis, inventor (to NASA), Vaughn D. Behun, inventor (to NASA), and Lewis R. Goodrich, Sr., inventor (to NASA) 29 Sep. 1992 12 p Filed 22 Jul. 1991 Supersedes N91-32511 (29 - 24, p 4028)
(NASA-Case-LAR-14352-1; US-Patent-5,150,875;
US-Patent-Appl-SN-735149; US-Patent-Class-248-550;
US-Patent-Class-188-378; Int-Patent-Class-F16M-13/00) Avail: US Patent and Trademark Office

A linear mass actuator includes an upper housing and a lower housing connectable to each other and having a central passageway passing axially through a mass that is linearly movable in the central passageway. Rollers mounted in the upper and lower housings in frictional engagement with the mass translate the mass linearly in the central passageway and drive motors operatively coupled to the roller means, for rotating the rollers and driving the mass axially in the central passageway.
Official Gazette of the U.S. Patent and Trademark Office

N92-34205*# National Aeronautics and Space Administration. Pasadena Office, CA.

HAZARDOUS MATERIALS EMERGENCY RESPONSE MOBILE ROBOT Patent Application

Henry W. Stone, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), James Lloyd, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), and George Alahuzos, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 20 Jul. 1992 25 p
(Contract NAS7-918)
(NASA-Case-NPO-18690-1-CU; NAS 1.71:NPO-18690-1-CU;
US-Patent-Appl-SN-917554) Avail: CASI HC A03/MF A01

A simple or unsophisticated robot incapable of effecting straight-line motion at the end of its arm inserts a key held in its end effector or hand into a door lock with nearly straight-line motion by gently thrusting its back heels downwardly so that it pivots forwardly on its front toes while holding its arm stationary. The relatively slight arc traveled by the robot's hand is compensated by a complaint tool with which the robot hand grips the door key. A visible beam is projected through the axis of the hand or gripper on the robot arm end at an angle to the general direction in which the robot thrusts the gripper forward. As the robot hand approaches a target surface, a video camera on the robot wrist watches the beam spot on the target surface fall from a height proportional to the distance between the robot hand and the target surface until the beam spot is nearly aligned with the top of the robot hand. Holes in the front face of the hand are connected through internal passages inside the arm to an on-board chemical sensor. Full rotation of the hand or gripper about the robot arm's wrist is made possible by slip rings in the wrist which permit passage of the gases taken in through the nose holes in the front of the hand through the wrist regardless of the rotational orientation of the wrist. NASA

N92-34207*# Case Western Reserve Univ., Cleveland, OH.

THERMAL MECHANICAL ANALYSIS OF SPRAG CLUTCHES Final Report

Robert L. Mullen, Ronald Joseph Zab, and Antonius S. Kurniawan
7 Jul. 1992 236 p
(Grant NAG3-653)
(NASA-CR-190686; NAS 1.26:190686) Avail: CASI HC A11/MF A03

Work done at Case Western Reserve University on the Thermal Mechanical analysis of sprag helicopter clutches is reported. The report is presented in two parts. The first part is a description of a test rig for the measurement of the heat generated by high speed sprag clutch assemblies during cyclic torsional loading. The second part describes a finite element modeling procedure for sliding contact. The test rig provides a cyclic torsional load of 756 inch-pounds at 5000 rpm using a four-square arrangement. The sprag clutch test unit was placed between the high speed pinions of the circulating power loop. The test unit was designed to have replaceable inner ad outer races, which contain the instrumentation to monitor the sprag clutch. The torque loading device was chosen to be a water cooled magnetic clutch, which is controlled either manually or through a computer. In the second part, a Generalized Eulerian-Lagrangian formulation for non-linear dynamic problems is developed for solid materials. This formulation is derived from the basic laws and axioms of continuum mechanics. The novel aspect of this method is that we are able to investigate the physics in the spatial region of interest as material flows through it without having to follow material points. A finite element approximation to the governing equations is developed. Iterative Methods for the

solution of the discrete finite element equations are explored. A FORTRAN program to implement this formulation is developed and a number of solutions to problems of sliding contact are presented. Author

N92-34212*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
COUNTER-BALANCED, MULTIPLE CABLE CONSTRUCTION CRANE Patent Application
Martin M. Mikulas, Jr., inventor (to NASA) and Li-Farn Yang, inventor (to NASA) (Colorado Univ., Boulder.) 18 Nov. 1991 21 p
(NASA-Case-LAR-14565-1-CU; NAS 1.71:LAR-14565-1-CU; US-Patent-Appl-SN-793974) Avail: CASI HC A03/MF A01

The invention is a counter-balanced, multiple cable construction crane. The apparatus for hoisting payloads comprises a crane having a lifting means, the lifting means comprising an end effector means and three suspension means or cables. One end of each cable attaches to a different winding means located on the lifting means, and the other end of each cable attaches to a different point on the end effector, such that the three cables have a theoretical point of convergence with this point corresponding to the center of mass of the payload. Three controls command rotation of the winding means to a predetermined position. Accordingly, the crane provides precise and autonomous positioning of the payload without human guidance. The crane further comprises a counter-balancing means. Two controls position the counter-balancing means to offset the overturning moment which arises during the lifting of heavy payloads. NASA

N92-34216*# Battelle Columbus Labs., OH.
SPACE STATION LONG TERM LUBRICATION ANALYSIS. PHASE 1 PRELIMINARY TRIBOLOGICAL SURVEY
K. F. Dufrane, J. W. Kannel, J. A. Lowry, and E. E. Montgomery (Spectra Research Systems, Inc., Huntsville, AL.) 21 Sep. 1990 62 p
(Contract NAS8-36655)
(NASA-CR-184365; NAS 1.26:184365) Avail: CASI HC A04/MF A01

Increases in the size, complexity, and life requirements of satellites and space vehicles have put increasing demands on the lubrication requirements for trouble-free service. Since the development costs of large systems are high, long lives with minimum maintenance are dictated. The Space Station represents the latest level of size and complexity in satellite development; it will be nearly 100 meters in major dimensions and will have a life requirement of thirty years. It will have numerous mechanisms critical to its success, some of which will be exposed to the space environment. Designing long-life lubrication systems and choosing appropriate lubricants for these systems will be necessary for their meeting the requirements and for avoiding failures with associated dependent mechanisms. The purpose of this program was to identify the various critical mechanisms and review their designs during the overall design and development stage so that problem areas could be avoided or minimized prior to the fabrication of hardware. The specific objectives were fourfold: (1) to perform a tribology survey of the Space Station for the purpose of documenting each wear point as to materials involved, environmental conditions, and operating characteristics; (2) to review each wear point (point of relative motion) as to the lubrication used and substrate materials selected in the context of its operating characteristics and the environmental conditions imposed; (3) to make recommendations for improvement in areas where the lubricant chosen and/or where the substrate (materials of the wear couple) are not considered optimum for the application; and (4) to make or recommend simulated or full scale tests in tribological areas where the state-of-the-art is being advanced, in areas where new designs are obviously being employed and a critical review would indicate that problems are a strong possibility, and/or where excessive wear, a malfunction, or excessive leakage would create fluid systems problems or contamination of exposed optical equipment. Author

N92-34224*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
WEAR MECHANISMS FOUND IN ANGULAR CONTACT BALL BEARINGS OF THE SSME'S LOX TURBOPUMP
T. J. Chase Jul. 1992 113 p
(NASA-TM-103596; NAS 1.15:103596) Avail: CASI HC A06/MF A02

Extensive experimental investigations were carried out on used flight bearings of the Phase 2 high-pressure oxygen turbopump (HPOTP) of the Space Shuttle Main Engine (SSME) in order to determine the wear mechanisms, dominant wear modes, and their extent and causes. The report shows methodology, surface analysis techniques used, result, and discussion. The mode largely responsible for heavy bearing wear in LOX was identified as adhesive/shear peeling of the upper layers of bearing balls and rings. The mode relies on the mechanisms of scale formation, breakdown, and removal, all of which are greatly enhanced by the heavy oxidation environment of the HPOTP. Major causes of the high wear in bearings appear to be lubrication and cooling, both inadequate for the imposed conditions of operation. Numerous illustrations and evidence are given. Author

N92-34242*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
CHECK VALVE WITH POPPET DASHPOT/FRICTIONAL DAMPING MECHANISM Patent Application
Brian G. Morris, inventor (to NASA) 22 Jun. 1992 15 p
(NASA-Case-MSC-21950-1; NAS 1.71:MSC-21950-1; US-Patent-Appl-SN-902265) Avail: CASI HC A03/MF A01

An inline check valve for a flow line where the valve element is guided for inline travel forward and rearward of a valve sealing member and is spring biased to a closed sealing condition is presented. One of the guides for the valve element includes a dashpot housing with a bore and plunger member to control the rate of travel of the valve element in either direction, providing a guiding function. The plunger member is arranged with a dashpot ring to frictionally contact the dashpot bore and has an interior tortuous flow path from one side to the other side of the dashpot ring. The dashpot housing is not anchored to the valve body so that the valve can be functional even if the dashpot ring becomes jammed in the dashpot housing. NASA

N92-33349*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
PLUME INDUCED ENVIRONMENTS ON FUTURE LUNAR MISSION VEHICLES
Bill Rochelle (Lockheed Engineering and Sciences Co., Houston, TX.), Ruston Hughes (Lockheed Engineering and Sciences Co., Houston, TX.), and Steve Fitzgerald *In its* Third SEI Technical Interchange: Proceedings 1992 p 597-611 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33783# Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON LUNAR SURFACE OPERATION ROBOTS [GETSUMEN SAGYOU ROBOTTO NO KENTOU]
Michiaki Mizuochi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N92-33480# Galaxy Scientific Corp., Mays Landing, NJ.
CURRENT NONDESTRUCTIVE INSPECTION METHODS FOR AGING AIRCRAFT Final Report
George Ansley, Stephen Bakanas, Maurice Castronuova, Ted

Grant, and Frank Vichi Jun. 1992 134 p
(Contract DTFA03-89-C-00043)
(DOT/FAA/CT-91/5) Avail: CASI HC A07/MF A02

This report identifies and describes current methods used during the nondestructive inspection (NDI) of commercial transport aircraft for structural damage. The six most prevalent NDI methods identified are visual, eddy current, radiography, ultrasonic, penetrant, and magnetic particle. The physical principles, generalized performance characteristics, and typical applications associated with each method are described. In addition, descriptions of specific airframe and engine inspection practices are also presented. Author

N92-33577 Department of the Navy, Washington, DC.
PHASE CANCELLATION ENHANCEMENT OF ULTRASONIC EVALUATION OF METAL-TO-ELASTIC BONDING Patent
Paul M. Gammell, inventor (to Navy) 18 Feb. 1992 8 p Filed 17 May 1990
(AD-D015321; US-Patent-5,088,327; US-Patent-Appl-SN-524414; US-Patent-Class-73-588) Avail: US Patent and Trademark Office

Acoustical radiation is generated and applied to the bonding interface between a radiation transmission material and a radiation attenuating material to determine adhesion quality by extraction of data from a response signal produced by echoes reflected from both the interface and the radiation entry surface on the radiation transmissive material exposed to the generated acoustical radiation. Signal phase cancellation between the echoes from the entry surface and bonding interface produce a signal signature from which the quality of bonding is evaluated. By partial attenuation of the echo from the entry surface, the signature is maximized. GRA

N92-33627# Laser Technology, Inc., Norristown, PA
INSPECTION OF FABRICATED FUSELAGE PANELS USING ELECTRONIC SHEAROGRAPHY
John Tyson, II and Ben Feferman Jul. 1992 42 p
(Contract DTRS57-90-P-80922)
(DOT/FAA/CT-TN92/26) Avail: CASI HC A03/MF A01

The results of a proof of principle demonstration of using electronic shearography to detect induced damage in fabricated aircraft panels are presented. The demonstration was performed at the FAA's Aircraft Panel Test Facility in Waltham, Massachusetts and all shearography equipment and its operational support was provided by Laser Technology, Inc. (LTI) under a separate contract from the Volpe National Transportation Systems Center. The test panels that were inspected using the electronic shearography were constructed to closely simulate the fuselage and skin structure of Boeing 727 and 737 aircraft. These panels contained programmed flaws intended to simulate two major types of defects associated with aging aircraft, namely cracks along fastener rows, and disbonded tear strap doublers and lap joints. The proof of principle consisted of a series of inspections that demonstrated shearography's capability to detect cracks and disbonds in the fuselage panel specimens. The sensitivity of shearography to detect short, simulated fatigue cracks that would correspond to a multiple site damage situation was too low to provide sufficient confidence that the method could economically replace existing eddy current surface methods. The sensitivity of the method to detect panel disbonding, however, is sufficient to encourage further development of the technique. Author

N92-33642# Technische Univ., Delft (Netherlands). Mathematical Geodesy and Positioning Section.
QUALITY CONTROL AND INTEGRATION ASPECTS OF VEHICLE LOCATION SYSTEMS Thesis
C. C. J. M. Tiberius Aug. 1991 104 p
(ETN-92-92029) Avail: CASI HC A06/MF A02

Quality control and integration aspects of vehicle location systems are addressed in a feasibility study of an integrated navigation system for vehicle location applications. The data handling of such an integrated navigation system is implemented by means of a Kalman filter. The Kalman filter model consists of a dynamic model, which describes the motions of the vehicle, and a measurement model, which relates all kinds of observables to the system. Simulations were carried out in order to gain insight in the process of designing an optimal filter (optimal in the sense of precision and reliability). The theory of quality control appears to be feasible to operate in vehicle navigation. The navigation system considered consists of an arbitrary radio or satellite positioning system (coordinate observables), an (differential) odometer (observable velocity or distance travelled), and a magnetic compass (observable heading). The results of this system may serve as an indication of how to design a vehicle location system. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N92-33280# Dayton Univ., OH. Research Inst.
HIGH STRAIN RATE BEHAVIOR OF METALS, CERAMICS, AND CONCRETE Final Report, Sep. 1986 - Sep. 1991
A M. Rajendran Apr. 1992 225 p
(Contract F33615-86-C-5064)
(AD-A252979; UDR-TR-91-122; WL-TR-92-4006) Avail: CASI HC A10/MF A03

This report summarizes the major results obtained during the contractual period between September 1986 through December 1990. During this period, high strain rate behavior of various metals and ceramics was investigated through a combined experimental and computational approach. The experiments include quasi-static, split Hopkinson bar, rod-on-rod, plate-on-rod, and plate impact test configurations. Three-dimensional, loading history dependent, and internal state variable based constitutive models for metals and ceramics were developed. Damage, in terms of microvoids/cracks nucleation and growth, was treated as an internal state variable. The model constants for several metals and AD85 ceramic were determined and applied successfully to several impact problems. GRA

N92-33395# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMIC FRACTURE CRITERIA IN STRUCTURAL SOLIDS Final Report, 1 Oct. 1988 - 30 Sep. 1990
1 Sep. 1991 17 p
(Contract N00014-85-K-0596)
(AD-A252905) Avail: CASI HC A03/MF A01

The numerical part of our program was concerned with the development of very elaborate finite element models designed to investigate dynamic fracture phenomena and to accurately include the effects of three dimensionality, rate sensitivity and material inertia in the analysis of the dynamic failure process. Our most recent interests in this area included the use of continuum damage theories that model the void nucleation and growth process at the vicinity of dynamic cracks. These models were used for the numerical investigation of processes related to crack tip tunneling in ductile metals as well as the formation of shear lips during crack growth. The numerical computations were designed to simulate actual experimental arrangements, and their results were always compared by means of the optical and thermographic methods developed in or laboratory. GRA

N92-33476*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
INFLUENCE OF MASS MOMENT OF INERTIA ON NORMAL MODES OF PRELOADED SOLAR ARRAY MAST
Sasan C. Armand and Paul Lin (Cleveland State Univ., OH.) Aug. 1992 12 p
(RTOP 474-46-10)
(NASA-TP-3273; E-6847; NAS 1.60:3273) Avail: CASI HC A03/MF A01

Earth-orbiting spacecraft often contain solar arrays or antennas supported by a preloaded mast. Because of weight and cost considerations, the structures supporting the spacecraft appendages are extremely light and flexible; therefore, it is vital to investigate the influence of all physical and structural parameters that may influence the dynamic behavior of the overall structure. The study primarily focuses on the mast for the space station solar arrays, but the formulations and the techniques developed in this study apply to any large and flexible mast in zero gravity. Furthermore, to determine the influence on the circular frequencies, the mass moment of inertia of the mast was incorporated into the governing equation of motion for bending. A finite element technique (MSC/NASTRAN) was used to verify the formulation. Results indicate that when the mast is relatively flexible and long, the mass moment inertia influences the circular frequencies.
Author

N92-33485*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
THE MECHANICAL BEHAVIOR OF CROSS-ROLLED BERYLLIUM SHEET
J. A. Henkener (Lockheed Engineering and Sciences Co., Houston, TX.), I. K. Spiker (Lockheed Engineering and Sciences Co., Houston, TX.), and W. L. Castner Oct. 1992 56 p
(NASA-TM-4397; S-681; NAS 1.15:4397) Avail: CASI HC A04/MF A01

In response to the failure of a conical section of the Insat C satellite during certification testing, the use of beryllium for payload structures, particularly in sheet product form, is being reevaluated. A test program was initiated to study the tensile, shear, and out-of-plane failure modes of beryllium cross-rolled sheet and to apply data to the development of an appropriate failure criterion. Tensile test results indicated that sanding the surface of beryllium sheet has no significant effect on yield strength but can produce a profound reduction in ultimate strength and results obtained by finite element analysis. Critical examination of these test results may contribute to the modification of a JSC policy for the use of beryllium in orbiter and payload structures.
Author

N92-33580*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A STATE-OF-THE-ART ASSESSMENT OF ACTIVE STRUCTURES
Sep. 1992 87 p
(RTOP 590-14-41)
(NASA-TM-107681; NAS 1.15:107681) Avail: CASI HC A05/MF A01

A state-of-the-art assessment of active structures with emphasis towards the applications in aeronautics and space is presented. It is felt that since this technology area is growing at such a rapid pace in many different disciplines, it is not feasible to cover all of the current research but only the relevant work as relates to aeronautics and space. Research in smart actuation materials, smart sensors, and control of smart/intelligent structures is covered. In smart actuation materials, piezoelectric, magnetostrictive, shape memory, electrorheological, and electrostrictive materials are covered. For sensory materials, fiber optics, dielectric loss, and piezoelectric sensors are examined. Applications of embedded sensors and smart sensors are discussed.
Author

N92-33600# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
A FORCED VIBRATION NON-RESONANT METHOD FOR THE DETERMINATION OF COMPLEX MODULUS IN THE AUDIO FREQUENCY RANGE
Jeffrey P. Szabo Jan. 1992 29 p
(DREA-92-201; CTN-92-60601) Avail: CASI HC A03/MF A01

The unique properties of polymers make them ideally suited for damping structure-borne vibrations when used in anti-vibration mounts or sheet damping applications, and in reducing air- or water-borne sound when used in anechoic coatings. The frequency and temperature dependence of the viscoelastic properties of polymers is essential information for the selection and design of materials for noise and vibration damping. A forced vibration, nonresonant method for the determination of the dynamic mechanical properites of elastomeric materials in the audio frequency range was developed and evaluated using a commercial damping material, Isodamp C-1002. Measurements of storage modulus and loss factor were made in the 11 Hz to 10 kHz range on the material using compressive and tensile excitation. The elastomer had a loss factor near 1.0 and a storage modulus which varied between 6 MPa and 300 MPa in the frequency range studied. For tensile excitation, the error in the calculated modulus was low up to the resonance frequency of the sample, usually around 1700 Hz. For compressive excitation of thin sheets, the error was greatest at the low and high ends of the frequency range.
CISTI

N92-33709 National Physical Lab., Teddington (England). Materials Metrology Div.
TEST METHODS FOR ENVIRONMENT-ASSISTED CRACKING
A. Turnbull Mar. 1992 54 p
(NPL-DMM(A)-66; ETN-92-91993) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

The test methods for assessing environment assisted cracking of metals in aqueous solution are described. The advantages and disadvantages are examined and the interrelationship between results from different test methods is discussed. The source of differences in susceptibility to cracking occasionally observed from the varied mechanical test methods arises often from the variation between environmental parameters in the different test conditions and the lack of adequate specification, monitoring, and control of environmental variables. Time is also a significant factor when comparing results from short term tests with long exposure tests. In addition to these factors, the intrinsic difference in the important mechanical variables, such as strain rate, associated with the various mechanical tests methods can change the apparent sensitivity of the material to stress corrosion cracking. The increasing economic pressure for more accelerated testing is in conflict with the characteristic time dependence of corrosion processes. Unreliable results may be inevitable in some cases but improved understanding of mechanisms and the development of mechanistically based models of environment assisted cracking which incorporate the key mechanical, material, and environmental variables can provide the framework for a more realistic interpretation of short term data.
ESA

N92-33836 Washington Univ., Seattle.
TOWARD THE ROBUST CONTROL OF HIGH-BANDWIDTH HIGH-PRECISION FLEXIBLE OPTICAL SYSTEMS Ph.D. Thesis
Kenneth Wayne Barker 1991 194 p
Avail: Univ. Microfilms Order No. DA9131604

It is well known that control-structure-interaction (CSI) phenomena limit the stability and performance of controlled flexible structures. Most CSI research focuses on rigid body control of flexible structures with relatively low closed loop control bandwidths. This research examines the CSI phenomena associated with high bandwidth high precision control of a reaction actuator mounted to a flexible support structure. In particular, CSI using a high gain proportional integral-derivative (PID) controller is examined as it relates to certain design parameters. Rapid small angle line-of-sight repositioning and precision line-of-sight stabilization against a variety of disturbances are performed using both a single and multimode model. The single flexible mode model consists of a three-mass lightly damped translating system, referred to as the modified benchmark model. The multimode model consists of a single-axis reaction steering mirror mounted to the tip of a flexible truss-like support structure. CSI analysis of the reaction actuator control problem is performed first on the single-mode model as a function of flexible mode location, then with the multimode model as a function of inertial and elastic coupling between the reaction steering mirror and the flexible support structure. The analysis describes the CSI effects on both stability and performance of a high gain line-of-sight PID controller. This research introduces the idea of bicollocated control of a reaction actuator. It also shows that control of a reaction actuator in the classical 'collocated'

sense may lead to nonminimum phase zeros in the plant model and may result in an unstable closed loop system. The critical parameters affecting both stability and performance of high gain reaction actuator controllers on flexible systems are shown to be actuator natural frequency, actuator inertia, uncoupled flexible support structure model inertia, and coupled system model reaction inertia. Dissert. Abstr.

N92-33870 Ohio State Univ., Columbus.
SINGULARITIES IN PLATE VIBRATION PROBLEMS Ph.D. Thesis
Chiungshiann Huang 1991 220 p
Avail: Univ. Microfilms Order No. DA9130487

This dissertation presents the first known analytical studies of the effects of stress singularities in the vibration problems of thin plates. Solutions for the characteristic frequencies are obtained by means of the Ritz method. The admissible function space consists of a set of polynomials, which is mathematically complete, and some singularity functions or a set of corner functions, which exactly accounts for the local singularity behavior in the problems under consideration. The singularity functions and corner functions accelerate the convergence of numerical results so that accurate upper bound solutions can be produced before significant numerical roundoff errors arise. Mainly, three classes of problems are under investigation: (1) circular plates with point supports; (2) cantilevered, skewed plates (including parallelogram, trapezoidal, and triangular plates), where stress singularities exist at the re-entrant clamped corner; and (3) completely free circular plates having a V-notch, where stress singularities occur at the tip of the notch. Comparisons with the published results either from the finite element method or from other techniques based on the Ritz method demonstrate that the present approach gives better upper bounds of the exact solutions, especially for the cases with very strong stress singularities such as cantilevered skew plates with large skew angles. Accurate frequencies of the cantilevered skew plates with various aspect ratios and skew angles as well as the complete free circular plates having a V-notch at various locations and with various opening angles are supplied. Dissert. Abstr.

N92-33900*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATION OF FIBER BRIDGING MODELS TO FATIGUE CRACK GROWTH IN UNIDIRECTIONAL TITANIUM MATRIX COMPOSITES
J. G. Bakuckas, Jr. and W. S. Johnson Jul. 1992 54 p
(RTOP 763-23-41-85)
(NASA-TM-107588; NAS 1.15:107588) Avail: CASI HC A04/MF A01

Several fiber bridging models were reviewed and applied to study the matrix fatigue crack growth behavior in center notched (0)(sub 8) SCS-6/Ti-15-3 and (0)(sub 4) SCS-6/Ti-6Al-4V laminates. Observations revealed that fatigue damage consisted primarily of matrix cracks and fiber matrix interfacial failure in the (0)(sub 8) SCS-6/Ti-15-3 laminates. Fiber-matrix interface failure included fracture of the brittle reaction zone and cracking between the two carbon rich fiber coatings. Intact fibers in the wake of the matrix cracks reduce the stress intensity factor range. Thus, an applied stress intensity factor range is inappropriate to characterize matrix crack growth behavior. Fiber bridging models were used to determine the matrix stress intensity factor range in titanium metal matrix composites. In these models, the fibers in the wake of the crack are idealized as a closure pressure. An unknown constant frictional shear stress is assumed to act along the debond or slip length of the bridging fibers. The frictional shear stress was used as a curve fitting parameter to available data (crack growth data, crack opening displacement data, and debond length data). Large variations in the frictional shear stress required to fit the experimental data indicate that the fiber bridging models in their present form lack predictive capabilities. However, these models provide an efficient and relatively simple engineering method for conducting parametric studies of the matrix growth behavior based on constituent properties. Author

N92-33935*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PROBABILISTIC ASSESSMENT OF SPACE TRUSSES SUBJECTED TO COMBINED MECHANICAL AND THERMAL LOADS
Shantaram S. Pai and Christos C. Chamis 1992 10 p Presented at the 33rd Structures, Structural Dynamics and Materials Conference, Dallas TX, 13-15 Apr. 1992; cosponsored by AIAA, ASME, ASCE, AHS, and ASC Previously announced in IAA as A92-34325
(RTOP 553-13-00)
(NASA-TM-105429; E-6845; NAS 1.15:105429; AIAA Paper 92-2352) Avail: CASI HC A02/MF A01

A three-bay, space, cantilever truss is probabilistically evaluated to quantify the range of uncertainties of buckling loads and member forces due to nonuniform thermal loads, applied loads and moments (mechanical loads), and combination of both. The truss members are assumed to be made from Aluminum tubes or high modulus graphite-fiber/intermediate modulus epoxy-matrix composite tubes. Cumulative distribution function results show that certain combinations of thermal loads with mechanical loads reduce the probabilistic buckling loads and increase the magnitude of the member axial forces for the aluminum truss. The same trend is observed for the composite truss as well, as however, the thermal effects on the probabilistic buckling loads and member axial forces are not as substantial as that for an aluminum truss. This can be attributed to the large differences in the values of coefficient of thermal expansion. Finally, the sensitivities associated with the uncertainties in the structural, material, and load variables (primitive variables) are investigated. They show that buckling loads and member axial forces are most sensitive to the uncertainties in spacial (geometry) variables. Author

N92-33970 Purdue Univ., West Lafayette, IN.
ANALYSIS OF THICK SECTION COMPOSITE LAMINATES Ph.D. Thesis
Wei-Chong Liao 1991 136 p
Avail: Univ. Microfilms Order No. DA9132469

Three-dimensional effective moduli are used in the analysis of thick laminates consisting of a large number of repeating identical sublaminates. Local stresses and strains in the laminae are recovered from the global average stresses and strains. A global-local method is developed in which the effective modulus theory is used to model the thick laminate except for the local region where accurate stresses are desired. A finite element code employing this global-local concept is used to analyze delamination cracks, interlaminar stresses, and free edge stresses in thick laminates. The torsion problem of multilayer laminates is evaluated by three different approaches: the layer by layer local analysis, all global finite element method, and the derived analytical series solution. Numerical study shows that this analytical tool can achieve reliable results in conjunction with its superior efficiency. It also indicates that the torsion fracture of an edge cracked specimen is dominated by Mode 3 failure. An experimental configuration based on the torsion analysis of thick laminate is performed to measure the interlaminar Mode 3 fracture toughness of several angle ply composite systems. Test results show that the fracture toughness ranges from 460 N/m to 860 N/m for most interfaces.
Dissert. Abstr.

N92-33979# Sandia National Labs., Livermore, CA.
A MATERIALS TEST SYSTEM FOR STATIC COMPRESSION AT ELEVATED TEMPERATURES
J. S. Korellis, C. A. Steinhaus, and J. J. Totten Jun. 1992 23 p
(Contract DE-AC04-76DR-00789)
(DE92-016823; SAND-92-8212) Avail: CASI HC A03/MF A01

This report documents modifications to our existing computer-controlled compression testing system to allow elevated temperature testing in an evacuated environment. We have adopted an 'inverse' design configuration where the evacuated test volume is located within the induction heating coil, eliminating the expense

and minimizing the evacuation time of a much larger traditional vacuum chamber. DOE

N92-34002 Northwestern Univ., Evanston, IL.
AN INVERSE PROBLEM IN ELASTICITY Ph.D. Thesis
Weichung David Yeih 1991 85 p
Avail: Univ. Microfilms Order No. DA9129091

In this dissertation, we study the inverse problem in elasticity. More precisely speaking, we study an inverse problem in elasticity with partially overprescribed boundary conditions. The proposed problem is an ill-posed problem. The solution might not exist but is unique if it does exist. However, the solution does not continuously depend on data since the nature of the problem leads to a Fredholm integral equation of the first kind. The possible nonexistence of solution as well as the numerical instability are treated by the regularization method. However, the approach of solving this problem by a standard direct boundary element method fails because of the difficulty of integrations of singularities in the regularization method. To avoid this difficulty, we reformulate the problem by a fictitious boundary element method. The main benefit of this method is to avoid the singularities. To solve this problem numerically, we use constant elements to discretize boundaries and an iteration procedure method is used. Two numerical examples are shown by simply using the data obtained from designed forward problems. The results are reasonably close to the expected values. We consider the work as the initial stage of the study of inverse problems in elasticity. There exist many unanswered challenges in this proposed problem and related problems. Dissert. Abstr.

N92-34020# Arizona State Univ., Tempe.
CONTINUOUS DAMAGE MECHANICS: CRITICAL STATES
D. Krajcinovic 1992 20 p
(Contract DE-FG02-90ER-14111)
(DE92-014521; DOE/ER-14111/2) Avail: CASI HC A03/MF A01

Failure can occur in many distinctly different ways depending on the material, stress and strain fields, temperature field, environmental effects, strain rate, etc. The proposed research program will focus on a single well defined class of failure modes common to many structures and machine elements. This class of problems is characterized by a gradually evolving microscale process which at a certain point triggers a discontinuous or singular (qualitative) change of macroscale response. Consideration of critical states of cooperative processes requires radical departure from the well traveled paths. Recently developing methods of statistical physics seem to be applicable to the class of problems under consideration. These models are generally formulated as discrete enabling consideration of spatial-temporal complexities as they raise from the microstructural disorder. However, in many cases these models in the limit do not converge to the traditional continuum theories. DOE

N92-34030 California Univ., Los Angeles.
ON A FIRST-ORDER SHEAR DEFORMATION THEORY FOR LAMINATED ANISOTROPIC SHELLS AND PLATES Ph.D. Thesis
Chong Keun Chun 1991 250 p
Avail: Univ. Microfilms Order No. DA9135173

Shear constitutive relations for a first-order shear deformation theory (1st SDT) of laminated anisotropic shells and plates are formulated following Mindlin's procedure for homogeneous, isotropic plates. Because thickness-shear motions for laminated anisotropic thickness profiles may not be polarized in planes normal to the reference surface, the concept of generalized principal shear planes is introduced. These planes are established by a least-squares minimization of the out-of-plane motions of infinitely long thickness-shear waves based on an elasticity analysis of the profile. Typical shear rigidities for a variety of laminated composite and sandwich profiles are given. Furthermore, an extensive parametric study is presented to assess the modeling capability of these shear constitutive relations in a class of laminated composite and sandwich cylinders. Results based on linear three-dimensional elasticity theory as well as classical theory results are also given in order to fully understand the influence of anisotropy on the accuracy and ranges of validity of both 1st SDT and classical theories. It is seen that the proposed system of shear constitutive relations provides highly accurate frequency results over the range of anisotropy considered. Author

N92-34036 Cincinnati Univ., OH.
THE DYNAMICS OF FLEXIBLE MULTIBODY SYSTEMS: A FINITE SEGMENT APPROACH Ph.D. Thesis
John David Connelly 1991 121 p
Avail: Univ. Microfilms Order No. DA9124223

The dynamics of rotating beams such as turbine or rotorcraft blades was studied. This was done using a dynamic formulation modified by incorporating flexibility effects. Springs and dampers were added to the end of rigid elements. These springs and dampers simulated the flexibility of the structure. The first goal was to develop these springs and dampers and to implement them into the equations of motion of the system. The second goal was to try to better understand the motion of rotating beams. Hopefully, this type of analysis offers advantages over other methods that arenow being used. Dissert. Abstr.

N92-34063 Missouri Univ., Rolla.
DYNAMIC ANALYSIS AND VIBRATION CONTROL OF SMART STRUCTURAL MATERIALS Ph.D. Thesis
Ming-June Tzeng 1991 134 p
Avail: Univ. Microfilms Order No. DA9133832

Active vibration control of flexible beams with various boundary conditions was achieved by using distributed piezoelectric actuators. Properties of the piezo-film sensor and actuator were incorporated by using the strain theory for a deformed structure. The governing equation of this system involving the control voltage was derived based on the equilibrium equation. It is found that the approach has some advantages in simplifying the derivation as well as the computer simulation of the vibration control. The control algorithm was derived using Lyapunov's direct method. All modes of the beam can be controlled simultaneously by taking the angular velocity as its control parameter. Computer simulations of the active vibration control for flexible beams were done by using the feedback control loop. The experimental setup, including some device circuits, were used to verify the predictions. Results from simulations as well as experimental analysis were in satisfactory agreement. In addition to the Lyapunov control, other parameters were also used to perform the vibration control. The results indicated that linear velocity is also a good control parameter for vibration control for a beam system. Preliminary investigation of a smart cantilever plate was accomplished. Without deriving a control algorithm, the proper control parameter was decided by examining the control effectiveness of the simulation. It is found that bending angular velocity as well as linear velocity are the most effective control parameters to suppress vibration of the cantilever plate. Dissert. Abstr.

N92-34086 Illinois Univ., Chicago.
THE KINEMATICS OF DAMAGE DURING CRACK LAYER GROWTH Ph.D. Thesis
Xiaoqun Zhang 1991 123 p
Avail: Univ. Microfilms Order No. DA9132269

Investigations of crack initiation and slow crack propagation in single edge notched specimens of polystyrene, which is selected as a model material, subjected to low cycle fatigue loading are presented. Under the particular conditions investigated here, craze dissemination prior to initiation depends upon the notch tip radius. For a relatively sharp notch, two craze patterns are observed: a core of dense crazes in front of the notch tip and a peripheral less dense craze pattern which surrounds the core zone. For notches with relatively large notch tip radius, the core zone does not appear. Instead, individual crazes nucleate and grow in front of the notch. For the same notch tip radius and identical loading conditions, a difference in craze pattern is seen. An abrupt change in the craze pattern ahead of the notch tip is observed during a single loading cycle. This suggests a drastic change in the stress

field and presumingly associated with crack initiation. The time to initiation does not depend upon the geometry of the notch tip. The kinetics of the peripheral crazes resembles the behavior of short crack observed in various materials. Experimental characterization of craze distribution during slow crack propagation is performed on six consecutive locations of the active zone. Analysis of the experimental results shows that for the particular loading conditions and specimen geometry, the weighted center of gravity is located within the active zone and at a distance of about l(sub a)/3 (where l(sub a) is the length of the active zone) from the crack tip. Investigation of damage evolution is achieved by examination of ratios of inertia moments of the active zone as well as by the contours with equal damage density. For the particular fracture process, a linear transformation of points with equal damage density is adequate to describe damage evolution. The analysis shows that fracture propagates by the translation, isotropic expansion, and distortion of the active zone. Correspondingly, the energy release rates are given by the J sub 1, M, and N sub ij integrals. The results support the particular form of self-similarity of damage evolution adopted by the CL model. The resistance moments of active zone translation and isotropic expansion are expressed as products of average damage densities and functions of crack length. Dissert. Abstr.

N92-34112*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
APPLICATION OF COMPUTATIONAL FLUID DYNAMICS TO THE STUDY OF VORTEX FLOW CONTROL FOR THE MANAGEMENT OF INLET DISTORTION
Bernhard H. Anderson and James Gibb (Defence Research Agency, Bedford, England) Jul. 1992 12 p Presented at the 28th Joint Propulsion Conference and Exhibit, Nashville, TN, 6-8 Jul. 1992; sponsored by AIAA, SAE, ASME, and ASEE
(RTOP 505-62-52)
(NASA-TM-105672; E-7039; NAS 1.15:105672; AIAA Paper 92-3177) Copyright Avail: CASI HC A03/MF A01

The present study demonstrates that the Reduced Navier-Stokes code RNS3D can be used very effectively to develop a vortex generator installation for the purpose of minimizing the engine face circumferential distortion by controlling the development of secondary flow. The computing times required are small enough that studies such as this are feasible within an analysis-design environment with all its constraints of time and costs. This research study also established the nature of the performance improvements that can be realized with vortex flow control, and suggests a set of aerodynamic properties (called observations) that can be used to arrive at a successful vortex generator installation design. The ultimate aim of this research is to manage inlet distortion by controlling secondary flow through an arrangements of vortex generators configurations tailored to the specific aerodynamic characteristics of the inlet duct. This study also indicated that scaling between flight and typical wind tunnel test conditions is possible only within a very narrow range of generator configurations close to an optimum installation. This paper also suggests a possible law that can be used to scale generator blade height for experimental testing, but further research in this area is needed before it can be effectively applied to practical problems. Lastly, this study indicated that vortex generator installation design for inlet ducts is more complex than simply satisfying the requirement of attached flow, it must satisfy the requirement of minimum engine face distortion. Author

N92-34143*# Texas Univ., San Antonio. Div. of Engineering.
COMPUTATIONAL SIMULATION OF PROBABILISTIC LIFETIME STRENGTH FOR AEROSPACE MATERIALS SUBJECTED TO HIGH TEMPERATURE, MECHANICAL FATIGUE, CREEP, AND THERMAL FATIGUE Final Technical Report, Jan. 1991 - Aug. 1992
Lola Boyce, Callie C. Bast, and Greg A. Trimble Aug. 1992 36 p
(Grant NAG3-867)
(NASA-CR-190699; NAS 1.26:190699) Avail: CASI HC A03/MF A01

The results of a fourth year effort of a research program conducted for NASA-LeRC by The University of Texas at San Antonio (UTSA) are presented. The research included on-going development of methodology that provides probabilistic lifetime strength of aerospace materials via computational simulation. A probabilistic material strength degradation model, in the form of a randomized multifactor interaction equation, is postulated for strength degradation of structural components of aerospace propulsion systems subjected to a number of effects or primitive variables. These primitive variables may include high temperature, fatigue, or creep. In most cases, strength is reduced as a result of the action of a variable. This multifactor interaction strength degradation equation was randomized and is included in the computer program, PROMISC. Also included in the research is the development of methodology to calibrate the above-described constitutive equation using actual experimental materials data together with regression analysis of that data, thereby predicting values for the empirical material constants for each effect or primitive variable. This regression methodology is included in the computer program, PROMISC. Actual experimental materials data were obtained from industry and the open literature for materials typically for applications in aerospace propulsion system components. Material data for Inconel 718 was analyzed using the developed methodology. Author

N92-34156# Brown Univ., Providence, RI. Div. of Engineering.
ON PRESSURE-SHEAR PLATE IMPACT FOR STUDYING THE KINETICS OF STRESS-INDUCED PHASE TRANSFORMATIONS
Joanne C. Escobar and Rodney J. Clifton Jul. 1992 47 p
(Contract N00014-91-J-4169)
(AD-A253462; TR-1) Avail: CASI HC A03/MF A01

Pressure-shear plate impact experiments are proposed for studying the kinetics of stress-induced phase transformations. The purpose of this paper is to determine loading conditions and specimen orientations which can be expected to activate a single habit plane variant parallel to the impact plane, thereby simplifying the study of the kinetics of the transformation through monitoring the wave profiles associated with the propagating phase boundary. The Wechsler Lieberman-Read phenomenological theory was used to determine habit plane indices and directions of shape deformation for a Cu-Al-Ni shape memory alloy which undergoes a martensitic phase transformation under stress. Elastic waves generated by pressure-shear impact were analyzed for wave propagation in the direction of the normal to a habit plane. A critical resolved shear stress criterion was used to predict variants which are expected to be activated for a range of impact velocities and relative magnitudes of the normal and transverse components of the impact velocity. GRA

N92-34158# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
THE EFFECTS OF HYPERBOLIC HEAT CONDUCTION AROUND A DYNAMICALLY PROPAGATING CRACK TIP
James J. Mason and Ares J. Rosakis 1992 29 p
(Contract N00014-90-J-1340)
(AD-A253536; GALCIT-SM-92-3) Avail: CASI HC A03/MF A01

Using infrared detectors, researchers have recorded the temperature field around a dynamically propagating crack tip in several metals. At the same time, it was suggested that the temperature field around a propagating crack tip might exhibit some of the characteristics of hyperbolic heat conduction. It is shown, by using a corrected solution of the hyperbolic heat conduction equation for a traveling point source and by using an experimental estimate of the active plastic zone (heat generating zone) at a crack tip, that the effects of hyperbolic heat conduction around a propagating crack tip are not observed for the conditions of the experiments. It is shown that due to the adiabatic conditions at the crack tip the solution of the hyperbolic heat equation is indistinguishable from the solution of the parabolic heat conduction equation for crack propagation in steel. Some features of the solution are examined for conditions other than those in the experiments. GRA

N92-34174* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
METHOD OF RECERTIFYING A LOADED BEARING MEMBER Patent
Sidney G. Allison, inventor (to NASA) 29 Sep. 1992 14 p Filed 19 Jun. 1991 Supersedes N92-12302 (30 - 3, p 406)
(NASA-Case-LAR-14168-1; US-Patent-5,150,620; US-Patent-Appl-SN-717755; US-Patent-Class-73-862.59; US-Patent-Class-73-761; Int-Patent-Class-F16B-31/02) Avail: US Patent and Trademark Office

A method is described of recertifying a loaded bearing member using ultrasound testing to compensate for different equipment configurations and temperature conditions. The standard frequency F1 of a reference block is determined via an ultrasonic tone burst generated by a first pulsed phased locked loop (P2L2) equipment configuration. Once a lock point number S is determined for F1, the reference frequency F1a of the reference block is determined at this lock point number via a second P2L2 equipment configuration to permit an equipment offset compensation factor Fo1=((F1-F1a)/F1)(1000000) to be determined. Next, a reference frequency F2 of the unloaded bearing member is determined using a second P2L2 equipment configuration and is then compensated for equipment offset errors via the relationship F2+F2(Fo1)/1000000. A lock point number b is also determined for F2. A resonant frequency F3 is determined for the reference block using a third P2L2 equipment configuration to determine a second offset compensation factor F02=((F1-F3)/F1) 1000000. Next the resonant frequency F4 of the loaded bearing member is measured at lock point number b via the third P2L2 equipment configuration and the bolt load determined by the relationship (-1000000)CI(((F2-F4)/F2)-Fo2), wherein CI is a factor correlating measured frequency shift to the applied load. Temperature compensation is also performed at each point in the process.
Official Gazette of the U.S. Patent and Trademark Office

N92-34178*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EFFECTS OF CONSTRAINT ON CRACK GROWTH UNDER AIRCRAFT SPECTRUM LOADING
J. C. Newman, Jr. Sep. 1992 49 p
(RTOP 538-02-10-01)
(NASA-TM-107677; NAS 1.15:107677) Avail: CASI HC A03/MF A01

The objective is to study the effects of constraint on fatigue crack growth under aircraft spectrum loading. A plasticity-induced crack-closure model that accounts for constraint variations during the transition from flat-to-slant crack growth was used to correlate crack-growth rate data under constant-amplitude loading and to calculate crack growth under simulated aircraft spectrum loading. The model was applied to several thin-sheet aluminum alloy materials. Under laboratory air conditions, the transition was shown to be related to the size of the cyclic plastic zone based on the effective stress-intensity factor range for several sheet materials and thicknesses. Results from three-dimensional, elastic-plastic, finite-element analyses of a flat, straight-through crack in a thin-sheet aluminum alloy specimen showed a constraint loss similar to that assumed in the model. Using test data and the closure model, the location of the constraint-loss regime in terms of growth rate and the value of the constraint factor at these rates were determined by trial and error. The model was then used to calculate crack growth under the TWIST spectrum. The calculated results agreed reasonably well with test data. In general, the model predicted shorter crack-growth lives than tests under the TWIST spectrum by about 40 percent. For the TWIST spectrum clipped at Level 3, the calculated lives were within about 20 percent. The results demonstrated that constraint variations, especially for thin-sheet alloys, should be accounted for to predict crack growth under typical aircraft spectra. Author

N92-34191*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ADVANCES IN FATIGUE LIFE PREDICTION METHODOLOGY FOR METALLIC MATERIALS
J. C. Newman, Jr. Aug. 1992 46 p
(RTOP 505-63-50-04)
(NASA-TM-107676; NAS 1.15:107676) Avail: CASI HC A03/MF A01

The capabilities of a plasticity-induced crack-closure model to predict small- and large-crack growth rates, and in some cases total fatigue life, for four aluminum alloys and three titanium alloys under constant-amplitude, variable-amplitude, and spectrum loading are described. Equations to calculate a cyclic-plastic-zone corrected effective stress-intensity factor range from a cyclic J-integral and crack-closure analysis of large cracks were reviewed. The effective stress-intensity factor range against crack growth rate relations were used in the closure model to predict small- and large-crack growth under variable-amplitude and spectrum loading. Using the closure model and microstructural features, a total fatigue life prediction method is demonstrated for three aluminum alloys under various load histories. Author

N92-34221*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MODAL TEST/ANALYSIS CORRELATION OF SPACE STATION STRUCTURES USING NONLINEAR SENSITIVITY
Viney K. Gupta (Rockwell International Corp., Canoga Park, CA.), James F. Newell (Rockwell International Corp., Canoga Park, CA.), Laszlo Berke, and Sasan Armand Sep. 1992 10 p Presented at the Fourth Symposium on Multidisciplinary Analysis and Optimization, Cleveland, OH, 21-23 Sep. 1992; sponsored by AIAA/USAF, NASA, and OAI
(RTOP 474-46-10)
(NASA-TM-105850; E-7297; NAS 1.15:105850) Copyright Avail: CASI HC A02/MF A01

The modal correlation problem is formulated as a constrained optimization problem for validation of finite element models (FEM's). For large-scale structural applications, a pragmatic procedure for substructuring, model verification, and system integration is described to achieve effective modal correlation. The space station substructure FEM's are reduced using Lanczos vectors and integrated into a system FEM using Craig-Bampton component modal synthesis. The optimization code is interfaced with MSC/NASTRAN to solve the problem of modal test/analysis correlation; that is, the problem of validating FEM's for launch and on-orbit coupled loads analysis against experimentally observed frequencies and mode shapes. An iterative perturbation algorithm is derived and implemented to update nonlinear sensitivity (derivatives of eigenvalues and eigenvectors) during optimizer iterations, which reduced the number of finite element analyses. Author

42 GEOSCIENCES (GENERAL)

N92-34023*# Alabama Univ., Huntsville. Dept. of Computer Science.
EARTH SCIENCE DATA STUDY Final Report, 13 Sep. 1991 - 12 Jul. 1992
Sara J. Graves, Danny M. Hardin, and Helen Conover 12 Jul. 1992 7 p
(Contract NAS8-36955)
(NASA-CR-184380; NAS 1.26:184380) Avail: CASI HC A02/MF A01

The research proposed in this contract concerning investigations of existing and planned Earth Science and Applications Division (ESAD) data management systems and research into utilities for the access and display of scientific data products was completed. A summary of this work is provided. Author

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N92-33586# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF REMOTE SENSING IN STUDIES ABOUT THE FRACTURE TECTONICS [UTILIZACAO DE PRODUTOS DE SENSORIAMENTO REMOTO EM ESTUDOS SOBRE A TECTONICA DE FRATURAMENTO]
Athos RibeirodosSantos and Celio EustaquiodosAnjos Mar. 1991 17 p In PORTUGESE
(INPE-5360-RPQ/655) Avail: CASI HC A03/MF A01

The development of structural studies utilizing remote sensing data has provided systematic procedures of photointerpretation with the purpose of extracting structural and tectonic information in a regional scale. Some of these procedures are shown. The small scale remote sensing data are used in association with morphostructural analysis, indicating sedimentation controls related to the dynamic activities of the lineaments. The density analysis reveals mutual relations among the lineaments and interpretations about ancient fracture belts and relative age, and different types of the fault movimentation can be deduced. Examples are shown. Author

N92-33638# Technische Univ., Delft (Netherlands). Werkeenheid Fotogrammetrie en Remote Sensing.
PHOTOGRAMMETRY AND CONSERVATION OF MONUMENTS Thesis [FOTOGRAMMETRIE EN MONUMENTENZORG]
R. G. M. vanHaren Feb. 1992 145 p In DUTCH
(ETN-92-92025) Avail: CASI HC A07/MF A02

The application of architectural photogrammetry to the restoration of historical buildings is described, with a view to data collection for the Dutch historical city atlas. A literature study on restoration and architectural photogrammetry is presented. The accuracy of point determination was examined on the basis of simulated computations and photogrammetric measurements in photographs. It appears that in the case of a closed triangulation around a building control points do not have to be determined on every facade. The relative accuracy of the stereoscopic point determination of points on the building per facade is +/- 4 mm which is sufficient for architectural quality control. The estimated time required for a detailed photogrammetric survey of the entire selected test building is five weeks, assuming that about 30,000 have to be measured. ESA

N92-33640# Technische Univ., Delft (Netherlands). Fakulteit der Geodesie.
DETECTION OF ROAD NETWORKS IN SCANNED AERIAL PICTURES Thesis [DETECTIE VAN WEGENNETWERKEN IN GESCANDE LUCHTOPNAMEN]
Boudewijn V. Spiering Aug. 1991 138 p In DUTCH
(ETN-92-92027) Avail: CASI HC A07/MF A02

Different image processing methods which can be used for automatic detection of roads in digital images are addressed. The images are scanned color aerial photographs. Methods were also tested on panchromatic SPOT images. Two image transformations were performed in the three digital color components. The methods used can be divided into three groups: detection of initial segments, line following, and detection in the argumentation space. The methods are implemented as a road detection system in which, after the creation of initial segments and the argumentation space, new roads are predicted, alternating in the argumentation space or by line following. The accuracies were estimated taking into account the accumulation of errors on the different stages of the process. ESA

N92-33641# Technische Univ., Delft (Netherlands). Werkeenheid Fotogrammetrie en Remote Sensing.
AERIAL SURVEY USING A SEMI-METRIC CAMERA Thesis [LUCHTKAARTERING MET EEN SEMI-METRISCHE CAMERA]
J. P. A. Kuijpers Aug. 1991 131 p In DUTCH
(ETN-92-92028) Avail: CASI HC A07/MF A02

The possible application of a nonconventional survey and measurement system in aerial photogrammetry was investigated. As survey system, a single ended aeroplane Cessna 172 and a small format semi-metric camera, Rolleiflex 6006, was used. The measurement system is the monocular Rolleimetric MR2 system. Photographs were also measured with an analytical plotter Planicomp C100. The results show that neither the MR2 nor the Planicomp C100 system meet the requirement of the Dutch Survey Department. Improvements are suggested. ESA

N92-33643# Technische Univ., Delft (Netherlands). Faculty of Geodesy.
SOME ASPECTS OF MODERNIZING THE POLISH CADASTRE Thesis
P. Diepstraten Nov. 1991 134 p
(ETN-92-92030) Avail: CASI HC A07/MF A02

A description of the present state of the Polish cadastral system is given, including its tasks and the information it keeps. Organizational inefficiency is demonstrated by the fact that the cadastral organization is constituted of a multitude of more or less independent institutions in four levels of administration. As far as technical equipment is concerned, the Polish cadastre is reasonably equipped, but use of computers in cadastral departments is scarce. In a number of cities though, property registers are computerized. It is emphasized that reliable cadastral information is important for fast developing countries such as Poland, in view of the need of foreign and national investment in real estate. A number of technical and organizational recommendations are given to modernize the Polish cadastral services. A substantial part of the study is devoted to the technical and especially the financial sides of cadastral mapping. In a model, costs are assessed of different mapping alternatives. This part of the study can aid cadastral authorities, for instance those of the Polish cadastre, in choosing the appropriate method or mapping larger areas. ESA

N92-33691# Technische Univ., Berlin (Germany, F.R.). Fachgebiet Photogrammetrie und Kartographie.
EXAMINATION AND MAPPING OF FOREST DAMAGE USING REMOTE SENSING METHODS Final Report [DIGITALE GEOMETRISCHE AUFBEREITUNG MULTISENSORALER UND MULTITEMPORALER FERNERKUNDUNGSDATEN FUER DIE WALDSCHADENSFORSCHUNG]
Josef Brauers, Wolfgang Hartermann, and Frank Scholten Mar. 1991 79 p In GERMAN
(Contract BMFT-0339048-A)
(ETN-92-91913) Avail: CASI HC A05/MF A01

The geometrial processing of remote sensing data was examined. Application directrices were established. Specific methods for the processing of data from the various recording systems, e.g., aerial photographs, aircraft scanners, satellite video data, were developed. All methods were transformed into software modules and made available for further routine applications. The various program systems are working with standardized data structures, so that a communication of the single systems to one another is possible over the common, interfaces, for instance control point data. Processes for the compensation of digitalized aerial photographs were developed. ESA

N92-33692# Technische Univ., Delft (Netherlands). Werkeenheid Fotogrammetrie en Remote Sensing.
MOTOGRAPHY: ANALYSIS OF AN ANALOG AND A DIGITAL PHOTOGRAMMETRIC MEASUREMENT SYSTEM Thesis [MOTOGRAFIE: EEN ANALYSE VAN EEN ANALOOG EN EEN DIGITAAL FOTOGRAMMETRISCH MEETSYSTEEM]
D. J. Lange Nov. 1991 137 p In DUTCH
(ETN-92-92033) Avail: CASI HC A07/MF A02

Experimental motographic (photogrammetric motion analysis) research was carried out, whereby the positions of a moving object and the velocity of the object in two dimensional space were determined with an analog and a digital photographic system. The motographic system is described. A literature study showed how to take a photograph at a distance of 2.7 m of a moving light emitting diode fixed to the object. The accuracy of the analog and the digital system are sufficient for experimental motographic research. Recommendations for further research are given. ESA

N92-33738# General Accounting Office, Washington, DC. National Security and International Affairs Div.
NASA: CHANGES TO THE SCOPE, SCHEDULE, AND ESTIMATED COST OF THE EARTH OBSERVING SYSTEM. REPORT TO THE CHAIR, GOVERNMENT ACTIVITIES AND TRANSPORTATION SUBCOMMITTEE, COMMITTEE ON GOVERNMENT OPERATIONS, HOUSE OF REPRESENTATIVES
22 Jul. 1992 24 p
(GAO/NSIAD-92-223; B-248634) Avail: CASI HC A03/MF A01; GAO, PO Box 6015, Gaithersburg, MD 20877 HC

Congress funded the Earth Observing System (EOS) as a new NASA program beginning in fiscal year 1991. NASA proposed to launch about 30 types of earth observing instruments beginning in 1998. These instruments were intended to improve satellite data about the earth and to provide new data to support interdisciplinary studies of the earth. EOS is seen by NASA as the first step toward a future period of space-based scientific observation of the earth. The program is directly linked to the objectives of the U.S. Global Change Research Program and international efforts to observe and study the earth. The U.S. Global Change Research Program, which is funded by 11 agencies, is an attempt to achieve these objectives and to improve predictions of climate and other forms of global change. Within that program, EOS is intended to significantly improve scientists' abilities to model, and thereby predict, broad natural relationships among the sea, land, and atmosphere; to observe how water, carbon, and other substances move on the planet or are affected by variations in the sun's radiation; and to assess the impact of human activities on the earth's climate. Ultimately, EOS is to help determine the extent to which human activities are affecting the earth's environment and to provide policymakers with the information they will need to preserve the earth. Author

N92-33801# Technische Univ., Delft (Netherlands). Vakgroep Mathematische en Fysische Geodesie.
SURVEY CALCULATION USING THE FRANK SYSTEM Thesis [VERKENNINGSBEREKENINGEN MET HET FRANK-SYSTEEM]
K. W. Smit Sep. 1991 98 p In DUTCH
(ETN-92-92032) Avail: CASI HC A05/MF A02

The use of a novel photographic method for detailed measurements, FRANK (photographic registration of topography for analog image representation mapping) to produce a digital coordinate inventory is reported. The quality of the inventory was investigated, with emphasis on the mathematical aspects. The FRANK system and the methods for quality description of geodetic networks are described. It is shown that the only factors that affect the reliability of the inventory are the distance between the recording points and the number of triangulation points. The precision is affected by the distance and orientation of the recording points, the number of triangulation points, the location of the adjustment points, and the measurement of the inclination. ESA

N92-33831# European Space Agency, Paris (France). Directorate for Observation of the Earth and its Environment.
IMAGING SPECTROSCOPY AND ITS APPLICATION IN SPACEBORNE SYSTEMS: THE DEVELOPMENT OF A COHERENT STRATEGY FOR SCIENTIFIC AND APPLICATION ORIENTED USE OF IMAGING SPECTROSCOPY DATA FOR TERRESTRIAL INVESTIGATIONS Ph.D. Thesis - Ludwig-Maximilians-Univ.
M. Rast, ed., C. Barron, ed., and B. Battrick Dec. 1991 149 p Original contains color illustrations
(ESA-SP-1144; ISBN-92-9092-152-8; ETN-92-91974) Copyright Avail: CASI HC A07/MF A02

A study to investigate imaging spectrometer data with regard to processing, calibrating, the selection of spectral ranges for dedicated investigations, and the application of data to disciplinary questions for the purpose of understanding and deriving performance requirements for spaceborne systems is presented. The following topics are covered: (1) an introduction to imaging spectroscopy for remote sensing; (2) requirements and applications of imaging spectroscopy for spaceborne earth observation remote sensing; (3) data handling strategies for spaceborne imaging spectrometers; (4) calibration and atmospheric correction of airborne imaging spectrometer data using the example of the AVIRIS'89 Calibration Experiment; (5) scientific investigation of airborne imaging spectrometer data from a geological test site at Cuprite, Nevada; (6) applicability of imaging spectroscopy to vegetation studies; (7) oceanography, atmospheric, and large-scale terrestrial applications for a spaceborne imaging spectrometer; and (8) spatial reduction of imaging spectrometer data for transmission from spaceborne sensors. ESA

N92-34006# Winand Staring Centre, Wageningen (Netherlands).
REMOTE SENSING AND WATERSHED MODELLING: TOWARDS A HYDROLOGICAL INTERFACE MODEL
S. Azzali, W. G. M. Bastiaanssen, M. Menenti, H. deBrouwer (International Inst. for Aerospace Survey and Earth Sciences, Enschede, Netherlands), A. M. J. Meijerink (International Inst. for Aerospace Survey and Earth Sciences, Enschede, Netherlands), J. Maza (Instituto Nacional de Ciencia y Technica Hidricas, Mendoza, Argentina), and A. W. Zevenbergen (IWACO B.V., Rotterdam, Netherlands) 1991 116 p Sponsored by Beleidscommissie Remote Sensing
(Rept-48; BCRS-90-42; ETN-92-91612) Copyright Avail: CASI HC A06/MF A02

The objective was to identify the possibility of commercializing remote sensing products and services in the field of hydrology. The possibility of combining the Geographical Information System (GIS) and image processing system was assessed in such a way that it can be used as an input and output generator for a large spectrum of hydrological models, i.e., hydrological interface model. The basic information system selected for this study is ILWIS (Integrated Land and Water Information System), a personal computer based GIS which integrates image processing capabilities, tabular databases, and conventional GIS characteristics. With the aid of such a hydrological interface model, it is expected to improve the matter of detail in modeling hydrological processes in a watershed. ESA

N92-34037# Oak Ridge National Lab., TN.
IMAGING ALGORITHMS FOR GEOPHYSICAL APPLICATIONS OF IMPEDANCE TOMOGRAPHY
A. J. Witten and J. E. Molyneux (Widener Univ., Chester, PA.) 2 Jun. 1992 11 p Presented at the Inverse Problems in Scattering and Imaging, San Diego, CA, 19-24 Jul. 1992
(Contract DE-AC05-84OR-21400)
(DE92-016784; CONF-9207109-1) Avail: CASI HC A03/MF A01

The methods of impedance tomography may be employed to obtain images of subsurface electrical and conductivity variations. For practical reasons, voltages and currents are usually applied at locations on the ground surface or down a limited number of boreholes, but almost never over the entire surface of the region being investigated. The geophysical inversion process can be facilitated by constructing algorithms adopted to these particular geometries and to the lack of complete surface data. In this paper we assume that the fluctuations in conductivity are small compared to the background value. The imaging of these fluctuations is carried out exactly within the constraints imposed by the problem geometry. Several possible arrangements of injection and monitoring electrodes are considered. In two dimensions these include: cross-line geometry - current input along one line (borehole) and measurements along a separate parallel line; single-line geometry - injection and monitoring using the same borehole; and

surface reflection geometry - all input and measurement along the ground surface. Theoretical and practical limitations on the image quality produced by the algorithms are discussed. They are applied to several sets of simulated data, and the images produced are displayed and analyzed. DOE

N92-34069# Oak Ridge National Lab., TN.
ANALYZING SIMULATED PATTERNS OF LAND USE CHANGE
V. H. Dale, R. V. ONeill, F. Southworth, and F. Loureiro (Tennessee Univ., Knoxville.) 1992 11 p Presented at the 1992 American Society for Photogrammetry and Remote Sensing/American Congress on Surveying and Mapping/Resource Technology Convention on Monitoring and Mapping Global Change, Washington, DC, 3-8 Aug. 1992
(Contract DE-AC05-84OR-21400)
(DE92-015131; CONF-920892-1) Avail: CASI HC A03/MF A01

Land use change is one of the major factors affecting global environmental conditions. Modeling land use change requires combining spatially-explicit ecological information with socioeconomic factors. A modeling system is being developed that integrates sub-models of human colonization with submodels of ecological interactions to estimate patterns and rates of deforestation under different immigration and land management scenarios. The model projects maps of land use change that can be compared to remote sensing measures using spatial statistics. The simulation modeling system is being applied to the Brazilian state of Rondonia where deforestation has increased at a faster rate over the past two decades than anywhere else in the world. The model projections suggest that land management can both reduce carbon release and improve the length of time farmers are able to remain on the land. The model provides a tool to evaluate the spatial and temporal implications of various land management options. DOE

N92-34111*# Texas Univ., Austin. Dept. of Astronomy.
EARTH ROTATION PARAMETERS FROM AN ON-SITE STUDY OF LASER RANGING DATA Final Report, 15 Mar. 1986 - 30 Jun. 1992
Peter J. Shelus 25 Aug. 1992 13 p Original contains color illustrations
(Grant NAG5-754)
(NASA-CR-190668; NAS 1.26:190668) Avail: CASI HC A03/MF A01; 1 functional color page

A multi-faceted effort was maintained to achieve the following goals: (1) provide for state-of-the-art, on-site, near-real-time Earth orientation parameter determinations at levels of precision and accuracy commensurate with a 'quick-look' type of an analysis, using the lunar laser ranging (LLR) data type from the McDonald Laser Ranging Station (MLRS) and other LLR facilities around the world; (2) create a state-of-the-art, highly transportable, LLR-based Earth orientation solution package, which could be easily implemented at LLR facilities other than the MLRS; (3) accommodate, within the routine MLRS lunar range prediction and Earth orientation data analysis software packages, the standard set of Jet Propulsion Laboratory (JPL) Solar System ephemerides, lunar librations, and Solar System partial derivatives; and (4) examine, wherever possible, opportunities for the performance of state-of-the-art, on-site, joint, simultaneous, quick-look analysis for Earth orientation parameters, using both MLRS lunar and LAGEOS (and, perhaps, Etalon) ranging observations, as well as from multiple LLR station observations. Excellent results were obtained at all levels of effort and it can be said that all of these goals were attained. The reader is referred to the complete series of our semi-annual reports for a full description of our efforts. Author

N92-34228*# Purdue Univ., West Lafayette, IN. Lab. for Applications of Remote Sensing.
APPLYING REMOTE SENSING AND GIS TECHNIQUES IN SOLVING RURAL COUNTY INFORMATION NEEDS Final Report, 1 Jul. 1988 - 30 Sep. 1992
Chris J. Johannsen, R. Norberto Fernandez, and D. Fabian Lozano-Garcia 30 Sep. 1992 9 p
(Grant NAGw-1472)
(NASA-CR-190839; NAS 1.26:190839; LARS-Print-093092)
Avail: CASI HC A02/MF A01

The project designed was to acquaint county government officials and their clientele with remote sensing and GIS products that contain information about land conditions and land use. Other users determined through the course of this project were federal agencies working at the county level, agricultural businesses and others in need of spatial information. The specific project objectives were: (1) to investigate the feasibility of using remotely sensed data to identify and quantify specific land cover categories and conditions for purposes of tax assessment, cropland area measurements and land use evaluation; (2) to investigate the use of satellite remote sensing data as an aid in assessing soil management practices; and (3) to evaluate the use of remotely sensed data to assess soil resources and conditions which affect productivity. I.I.C.

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N92-33266# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIRECT CONVERSION TECHNOLOGY
L. H. Back, G. Fabris, and M. A. Ryan Jul. 1992 25 p
(Contract DE-AI01-86CE-90237)
(DE92-016619; JPL-D-9870) Avail: CASI HC A03/MF A01

The overall objective of the Direct Conversion Technology task is to develop an experimentally verified technology base for promising direct conversion systems that have potential application for energy conservation in the end-use sectors. Initially, two systems were selected for exploratory research and advanced development. These systems are the Alkali Metal Thermal-to-Electric Converter (AMTEC) and the Two-Phase Liquid Metal MHD Generator (LMMHD). This report describes progress that has been made during the first six months of 1992 on research activities associated with these two systems. DOE

N92-33271# Oak Ridge National Lab., TN.
PROOF OF CONCEPT OF A MAGNETICALLY COUPLED STIRLING ENGINE-DRIVEN HEAT PUMP
J. A. Shonder, Gong Chen (Sunpower, Inc., Athens, OH.), and J. McEntee (Sunpower, Inc., Athens, OH.) 1992 7 p Presented at the 27th Intersociety Energy Conversion Engineering Conference, San Diego, CA, 3-7 Aug. 1992
(Contract DE-AC05-84OR-21400)
(DE92-017129; CONF-920801-15) Avail: CASI HC A02/MF A01

A prototype magnetically-coupled Stirling engine-driven heat pump module has been designed and fabricated by Sunpower, Inc. under sponsorship of the US Department of Energy and the Oak Ridge National Laboratory (ORNL). Preliminary testing indicates that the magnetic coupling is an effective means for transmitting power from a free-piston Stirling engine to a refrigerant compressor. Compared with other power transmission concepts, the magnetic coupling has relatively low cost, and will help make commercial development of Stirling-driven heat pumps more likely in the future. DOE

N92-33401# Stanford Univ., CA. Dept. of Chemistry.
ENERGY TRANSFER PROCESSES IN SOLAR ENERGY CONVERSION
M. D. Fayer 1992 7 p
(Contract DE-FG03-84ER-13251)

(DE92-015605; DOE/ER-13251/T6) Avail: CASI HC A02/MF A01

During the past year, we have been working in three general areas: electronic excitation transport in clustered chromophore systems and other complex systems; photo-induced electron transfer and back transfer in liquid solutions in which diffusion and charge interactions are important; and the construction of a new two color dye laser system to enhance our experimental capability. DOE

N92-33895*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

THE ACHIEVEMENT OF LOW CONTACT RESISTANCE TO INDIUM PHOSPHIDE: THE ROLES OF Ni, Au, Ge, AND COMBINATIONS THEREOF

Navid S. Fatemi (Sverdrup Technology, Inc., Brook Park, OH.) and Victor G. Weizer Apr. 1992 8 p Presented at the 1992 Semi-Annual Meeting, San Francisco, CA, 27 Apr. - 1 May 1992; sponsored by the Materials Research Society

(Contract NAS3-25266; RTOP 506-41-11)

(NASA-TM-105770; E-7195; NAS 1.15:105770) Avail: CASI HC A02/MF A01

We have investigated the electrical and metallurgical behavior of Ni, Au-Ni, and Au-Ge-Ni contacts on n-InP. We have found that very low values of contact resistivity rho(sub c) in the E-7 omega-sq cm range are obtained with Ni-only contacts. We show that the addition of Au to Ni contact metallization effects an additional order of magnitude reduction in rho(sub c). Ultra-low contact resistivities in the E-8 omega-sq cm range are obtained with both the Au-Ni and the Au-Ge-Ni systems, effectively eliminating the need for the presence of Ge in the Au-Ge-Ni system. The formation of various nickel phosphides at the metal-InP interface is shown to be responsible for the observed rho(sub c) values in the Ni and Au-Ni systems. We show, finally, that the order in which the constituents of Au-Ni and Au-Ge-Ni contacts are deposited has a significant bearing on the composition of the reaction products formed at the metal-InP interface and therefore on the contact resistivity at that interface. Author

N92-33898*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

PROGRESS UPDATE OF NASA'S FREE-PISTON STIRLING SPACE POWER CONVERTER TECHNOLOGY PROJECT

James E. Dudenhoefer, Jerry M. Winter, and Donald Alger (Sverdrup Technology, Inc., Brook Park, OH.) Aug. 1992 12 p Proposed for presentation at the Nuclear Technologies for Space Exploration Conference, Jackson Hole, WY, 16-19 Aug. 1992; sponsored by ANS

(RTOP 590-13-11)

(NASA-TM-105748; E-7153; NAS 1.15:105748) Avail: CASI HC A03/MF A01

A progress update is presented of the NASA LeRC Free-Piston Stirling Space Power Converter Technology Project. This work is being conducted under NASA's Civil Space Technology Initiative (CSTI). The goal of the CSTI High Capacity Power Element is to develop the technology base needed to meet the long duration, high capacity power requirements for future NASA space initiatives. Efforts are focused upon increasing system power output and system thermal and electric energy conversion efficiency at least five fold over current SP-100 technology, and on achieving systems that are compatible with space nuclear reactors. This paper will discuss progress toward 1050 K Stirling Space Power Converters. Fabrication is nearly completed for the 1050 K Component Test Power Converter (CTPC); results of motoring tests of the cold end (525 K), are presented. The success of these and future designs is dependent upon supporting research and technology efforts including heat pipes, bearings, superalloy joining technologies, high efficiency alternators, life and reliability testing, and predictive methodologies. This paper will compare progress in significant areas of component development from the start of the program with the Space Power Development Engine (SPDE) to the present work on CTPC. Author

N92-33975# Midwest Research Inst., Golden, CO. National Renewable Energy Lab.

NREL SOLAR RADIATION RESOURCE ASSESSMENT PROJECT: STATUS AND OUTLOOK

D. Renne, C. Riordan, E. Maxwell, T. Stoffel, B. Marion, M. Rymes, S. Wilcox, and D. Myers May 1992 43 p

(Contract DE-AC02-83CH-10093)

(DE92-010551; NREL/TP-262-4679) Avail: CASI HC A03/MF A01

This report summarizes the activities and accomplishments of NREL's Solar Radiation Resource Assessment Project during fiscal year 1991. Currently, the primary focus of the SRRAP is to produce a 1961 - 1990 National Solar Radiation Data Base, providing hourly values of global horizontal, diffuse, and direct normal solar radiation at approximately 250 sites around the United States. Because these solar radiation quantities were measured intermittently at only about 50 of these sites, models were developed and applied to the majority of the stations to provide estimates of these parameters. Although approximately 93 percent of the data base consists of modeled data this represents a significant improvement over the SOLMET/ERSATZ 1952 - 1975 data base. The magnitude and importance of this activity are such that the majority of SRRAP human and financial resources were devoted to the data base development. However, in FY 1991 the SRRAP was involved in many other activities, which are reported here. These include the continued maintenance of a solar radiation monitoring network in the southeast United States at six Historically Black Colleges and Universities (HBCU's), the transfer of solar radiation resource assessment technology through a variety of activities, participation in international programs, and the maintenance and operation of NREL's Solar Radiation Research Laboratory. DOE

N92-34049# Midwest Research Inst., Golden, CO. National Renewable Energy Lab.

MANUFACTURING WITH THE SUN

L. M. Murphy, S. G. Hauser, and R. J. Clyne May 1992 8 p Presented at the 7th DOE Workshop on CAE, Knoxville, TN, 29 Dec. 1991

(Contract DE-AC02-83CH-10093)

(DE92-001155; NREL/TP-250-4516; CONF-911237-7) Avail: CASI HC A02/MF A01

Concentrated solar radiation is now a viable alternative energy source for many advanced manufacturing processes. Researchers at the National Renewable Energy Laboratory (NREL) have demonstrated the feasibility of processes such as solar-induced surface transformation of materials (SISTM), solar-based manufacturing, and solar-pumped lasers. Researchers are also using sunlight to decontaminate water and soils polluted with organic compounds; these techniques could provide manufacturers with innovative alternatives to traditional methods of waste management. The solar technology that is now being integrated into today's manufacturing processes offers even greater potential for tomorrow, especially as applied to the radiation-abundant environment available in space and on the lunar surface. DOE

N92-34050# Midwest Research Inst., Golden, CO. National Renewable Energy Lab.

HIGH-FLUX SOLAR PHOTON PROCESSES: OPPORTUNITIES FOR APPLICATIONS

J. I. Steinfeld (Massachusetts Inst. of Tech., Cambridge.), S. L. Coy (Massachusetts Inst. of Tech., Cambridge.), H. Herzog (Massachusetts Inst. of Tech., Cambridge.), J. A. Shorter (Massachusetts Inst. of Tech., Cambridge.), M. Schlamp (Massachusetts Inst. of Tech., Cambridge.), J. W. Tester (Massachusetts Inst. of Tech., Cambridge.), and W. A. Peters (Massachusetts Inst. of Tech., Cambridge.) Jun. 1992 79 p

(Contract DE-AC02-83CH-10093)

(DE92-001246; NREL/TP-253-4422) Avail: CASI HC A05/MF A01

The overall goal of this study was to identify new high-flux solar photon (HFSP) processes that show promise of being feasible and in the national interest. Electric power generation and hazardous waste destruction were excluded from this study at

sponsor request. Our overall conclusion is that there is promise for new applications of concentrated solar photons, especially in certain aspects of materials processing and premium materials synthesis. Evaluation of the full potential of these and other possible applications, including opportunities for commercialization, requires further research and testing. DOE

N92-34064# New Energy Development Organization, Tokyo (Japan).
PROCEEDINGS OF THE 11TH BUSINESS REPORTING CONFERENCE OF THE NEDO GEOTHERMAL SUBCOMMITTEE
Korata Masahiro Oct. 1991 87 p In JAPANESE Conference held in Japan, Oct. 1991
(DE92-526277; ETDE/JP-mf-92526277) Avail: CASI HC A05/MF A01

The geothermal energy department at The New Energy and Industrial Technology Overall Development Organization carries out the following activities: a systematic identification of geothermal resource distribution all over Japan; discussions on selection of promising areas together with the criteria for exploration methods by volcanic thermal type; development of integrated analytic methods applied with high-level information processing technologies; site surveys on effectiveness of various physical exploration technologies; and surveys on environmental influence associated with developments. Developments under way on geothermal power generation systems include the following: development of an identification test for simplified medium-to-small size geothermal generation systems at the Kirishima area; and a 10 MW class plant for unused hydrothermal water resources. These developments were made with respect to utilizing geothermal energy possessed by high-temperature rocks, artificial reservoir bed formation by means of the hydraulic fracturing method, evaluation of reservoir bed characteristics by means of well excavation, and circulating heat extraction tests. DOE

N92-33330*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
DYNAMIC ISOTOPE POWER SYSTEMS FOR FLO
Maribeth E. Hunt *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 364-372
(For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

N92-33333*# Optical Energy Technologies, Inc., Stamford, CT.
THE MOON AS A SOLAR POWER SATELLITE
Gerald Falbel *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 406-420
(For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

N92-33794# Power Reactor and Nuclear Fuel Development Corp., Oarai (Japan).
STUDY OF POTASSIUM TURBINE ELECTRIC GENERATOR SYSTEM [KARIUMU TABIN HATSUDEN SHISUTEMU NO KENTOU]
Hiroshi Seino, Kazuo Haga, Hajime Kataoka, and Akira Ootsubo *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 31 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N92-33454# Pacific Northwest Lab., Richland, WA. Environmental Management Operations.
ENVIRONMENTAL ASSESSMENTS IN THE US: A CASE STUDY
J. M. Doesburg May 1992 10 p Presented at the Institute for International Research (IIR) Environmental Audits, Sydney (Australia), 20-21 May 1992
(Contract DE-AC06-76RL-01830)
(DE92-015070; EMO-SA-5007; CONF-9205184-2) Avail: CASI HC A02/MF A01

The 1990's is the decade of international environmental activism. The concerns and issues that are the basis of this activism are now extremely important to business. Numerous environmental issues will affect business decisions, and a keen awareness of the implications of those issues may make the difference financial success or ruin. Environmental assessments have become the tool to help business cope with an important environmental concern. This talk is focused on environmental assessments as they are practiced in the United States. Environmental activism has been a factor in business decisions since the passage of the Clean Air Act in 1963. This paper will discuss the current standards of practice in the US, the needs for assessments at industrial facilities, and a case study from a US industrial facility. More than 750,000 commercial real estate transactions take place in the US each year. Each of these transactions has a potential liability for the buyer and lender as a result of environmental impairment caused by hazardous materials located in buildings on sites, in the soil, or in the groundwater. Persons who knowingly or unknowingly acquire environmentally impaired property or who lend the money to purchase that property are liable for the cost of cleanup. DOE

N92-33523# Southern Methodist Univ., Dallas, TX. Dept. of Statistical Science.
STATISTICAL EXAMINATION OF CLIMATOLOGICAL DATA RELEVANT TO GLOBAL TEMPERATURE VARIATION
H. L. Gray, R. F. Gunst, and W. A. Woodward Jan. 1992 12 p
(Contract DE-FG05-90ER-61015)
(DE92-013654; DOE/ER-61015/T1) Avail: CASI HC A03/MF A01

The research group at Southern Methodist University has been involved in the examination of climatological data as specified in the proposal. Our efforts have resulted in three papers which have been submitted to scholarly journals, as well as several other projects which should be completed either during the next six months or next year. In the following, we discuss our results to date along with projected progress within the next six months. Major topics discussed in this progress report include: testing for trend in the global temperature data; defining and estimating mean global temperature change; and the effect of initial conditions on autoregressive models for global temperature data. DOE

N92-33578# Alaska Univ., Fairbanks. Geophysical Inst.
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON THE ROLE OF THE POLAR REGIONS IN GLOBAL CHANGE, VOLUME 1 Final Report, 1 May 1990 - 30 Apr. 1991
Gunter Weller Mar. 1992 361 p Proceedings held in Fairbanks, AK, 11-15 Jun. 1990
(Contract DAAL03-90-G-0126)
(AD-A253027; ARO-27859.1-GS-CF-Vol-1) Avail: CASI HC A16/MF A03

The goal of the conference was to define and summarize the state of knowledge on the role of the polar regions in global change, and to identify gaps in knowledge. To this purpose experts in a wide variety of relevant disciplines were invited to present papers and hold panel discussions. While there are numerous conferences on global change, this conference dealt specifically with the polar regions which occupy key positions in the global system. Over 400 scientists from 15 different countries attended and presented 200 papers on research in the Arctic and Antarctic. The papers were distributed among seven major themes and sessions, each having about three invited papers, a dozen contributed papers, and 15-20 poster papers. These papers, or their abstracts, are contained in the two proceedings volumes. In publishing the papers we did not distinguish between invited, contributed, or poster papers, but gave them all equal weight. On the final day of the conference three panels met to discuss problems and priorities in polar research. A summary of their recommendations follows the final section of papers. GRA

N92-33579# Alaska Univ., Fairbanks. Geophysical Inst.
PROCEEDINGS OF INTERNATIONAL CONFERENCE ON THE ROLE OF THE POLAR REGIONS IN GLOBAL CHANGE, VOLUME 2 Final Report, 1 May 1990 - 30 Apr. 1991
Gunter Weller Mar. 1992 492 p Proceedings held in Fairbanks, AK, 11-15 Jun. 1990
(Contract DAAL03-90-G-0126)
(AD-A253028; ARO-27859.2-GS-CF-Vol-2) Avail: CASI HC A21/MF A04

The International Conference on the Role of the Polar Regions in Global Change took place on the campus of the University of Alaska Fairbanks on June 11-15, 1990. It was cosponsored by several national and international scientific organizations, as listed on the preceding page. The host institutions were the Geophysical Institute and the Center for Global Change and Arctic System Research, both at the University of Alaska Fairbanks. The goal of the conference was to define and summarize the state of knowledge on the role of the polar regions in global change, and to identify gaps in knowledge. To this purpose experts in a wide variety of relevant disciplines were invited to present papers and hold panel discussions. While there are numerous conferences on global change, this conference dealt specifically with the polar regions which occupy key positions in the global system. Conference,--Global Change, Polar Regions, Global System Over 400 scientists from 15 different countries attended and presented 200 papers on research in the Arctic and Antarctic. The papers were distributed among seven major themes and sessions, each having about three invited papers, a dozen contributed papers, and 15-20 poster papers. These papers, or their abstracts, are contained in the two proceedings volumes. In publishing the papers we did not distinguish between invited, contributed, or poster papers, but gave them all equal weight. On the final day of the conference three panels met to discuss problems and priorities in polar research. A summary of their recommendations follows the final section of papers. GRA

N92-33702# Army Construction Engineering Research Lab., Champaign, IL.
ENVIRONMENTAL SENSOR TECHNOLOGIES AND PROCEDURES FOR DETECTING AND IDENTIFYING INDOOR AIR POLLUTION Final Report
Eileen T. OConnor, Don Kermath, and Michael R. Kemme Mar. 1992 26 p
(AD-A252260; CERL-IR-P-92/07) Avail: CASI HC A03/MF A01

Public concern about environmental quality now encompasses the indoor environment-the buildings where people work and live. In recent years researchers have been discovering new links between indoor air quality (IAQ) and the occupants' comfort, health, and productivity. As the operator of many thousands of buildings, and the employer of the millions of people who use those buildings, the U.S. Army has a strong interest in maintaining and promoting good IAQ. This report presents a concise summary of the key IAQ parameters of interest to building managers, the most common indoor air contaminants, the variety of sensor technology currently available for detecting and identifying those contaminants, and basic procedures for using that technology. GRA

N92-33751# Rolls-Royce Ltd., Derby (England).
THE IMPACT OF AIR TRANSPORT ON THE ENVIRONMENT
M. T. Metcalfe, R. A. Eaton, and D. M. Snape 1 Oct. 1991 9 p
(PNR-90876; ETN-92-92186) Copyright Avail: CASI HC A02/MF A01

The impact of atmospheric emissions upon the environment and the understanding of the contribution made by aircraft engines to pollution globally, in the vicinity of airports and at high altitudes, are considered. The technical status and future improvements in combustor technology, now under development, are addressed generally. The often conflicting requirements of emissions reduction and the other established combustor performance factors are examined. Particular stress is placed on safety aspects. The concept of an Environmental Impact Parameter (EIP), which would allow the optimization of engine cycle, and combustor design, to minimize the environmental consequences throughout the flight cycle, is introduced. The EIP could take into account the relative environmental importance of each emission species. ESA

N92-33840 Harvard Univ., Cambridge, MA.
ATMOSPHERIC RESIDENCE TIMES OF CONTINENTAL AEROSOLS Ph.D. Thesis
Yves Jacques Balkanski 1991 227 p
Avail: Univ. Microfilms Order No. DA9131907

The global atmospheric distributions of Rn-222 are simulated with a three-dimensional model of atmospheric transport based on the meteorology of the NASA Goddard Institute for Space Studies (GISS) general circulation model. The short-lived radioactive gas Rn-222 (half-life = 3.8d) is emitted almost exclusively from land, at a relatively uniform rate; hence it is an excellent tracer of continental influences. Lead-210 is produced by decay of Rn-222 and immediately condenses to preexisting aerosol surfaces. It provides an excellent measure of aerosol residence times in the atmosphere because its source is accurately defined by the Rn-222 distribution. Results from the three-dimensional model are compared to measurements of Rn-222 and Pb-210 atmospheric concentrations to evaluate model's long-range transport over oceanic regions and to study the deposition mechanisms of atmospheric aerosols. Model results for Rn-222 are used to examine the long-range transport of continental air over two selected oceanic regions, the subantarctic Indian Ocean and the North Pacific. It is shown that the fast transport of air from southern Africa causes substantial continental pollution at southern mid-latitudes, a region usually regarded as pristine. Air over the North Pacific is heavily impacted by continental influences year round, but the altitude at which the transport occurs varies seasonally. Observations of aerosols at island sites, which are commonly used as diagnostics of continental influences, may be misleading because they do not account for influences at high altitude and because aerosols are efficiently scavenged by deposition during transport. The study of Pb-210 focuses on defining the residence times of submicron aerosols in the troposphere. Scavenging in wet convective updrafts is found to provide the dominant sink on a global scale. The globally averaged residence time for Pb-210-containing aerosols in the troposphere is 7 days. The average increase in residence time with altitude is from 4 days near the surface to 25 days near the tropopause. Hence, aerosols produced in the upper troposphere can be transported on a global scale. Residence times averaged over the tropospheric column vary geographically from less than 2 days in rainy regions to more than 30 days in dry regions. In particular, aerosols produced by biomass burning over central Africa during the dry season might affect large areas over the tropical Atlantic Ocean, with possible implications for weather and climate.
Dissert. Abstr.

N92-33843 New York Univ., New York.
CARBONATE-SILICATE CYCLE MODELS OF THE LONG-TERM CARBON CYCLE, CARBONATE ACCUMULATION IN THE OCEANS, AND CLIMATE Ph.D. Thesis
Kenneth George Caldeira 1991 261 p
Avail: Univ. Microfilms Order No. DA9134648

Several models of the long-term carbon cycle, incorporating models of the carbonate-silicate cycle, were developed and utilized to investigate issues relating to global climate and the causes and consequences of changes in calcium carbonate accumulation in the oceans. Model results indicate that the marked mid-Cretaceous (120 Ma) global warming could be explained by increased rates of release of carbon dioxide from subduction-zone metamorphism and mid-ocean-ridges, in conjunction with paleogeographic factors. Since the mid-Cretaceous, the primary setting for calcium carbonate accumulation in the oceans has shifted from shallow-water to deep-water environments. Model results suggest that this shift could have major consequences for the carbonate-silicate cycle and climate, and lead to significant increases in the flux of metamorphic carbon dioxide to the atmosphere. Increases in pelagic carbonate productivity, and

decreases in tropical shallow-water area available for neritic carbonate accumulation, have both been proposed as the primary cause of this shift. Two lines of evidence developed here (one involving a statistical analysis of Tertiary carbonate-accumulation and oxygen-isotope data, and another based on modeling the carbonate-silicate cycle and ocean chemistry) suggest that a decrease in tropical shallow-water area was more important than increased pelagic productivity in explaining this shift. Model investigations of changes in ocean chemistry at the Cretaceous/Tertiary (K/T) boundary (66 Ma) indicate that variations in deep-water carbonate productivity may affect shallow-water carbonate accumulation rates through a mechanism involving surface-water carbonate-ion concentration. In the aftermath of the K/T boundary event, deep-water carbonate production and accumulation were significantly reduced as a result of the extinction of calcareous plankton. Results of a carbonate-silicate cycle model incorporating a shallow-water carbonate-accumulation parameterization indicate that increases in shallow-water carbonate accumulation associated with changes in carbonate-ion concentration may have partially compensated for decreases in deep-water carbonate accumulation. Dissert. Abstr.

N92-33936# British National Space Centre, London (England).
THE RELEVANCE OF SATELLITE MISSIONS TO THE STUDY OF THE GLOBAL ENVIRONMENT
1992 114 p Presented at the UNCED Conference, Rio de Janeiro, Brazil, 1992 Prepared in cooperation with Committee on Earth O bservations Satellites, London, England; Smith System Engineering Limited, Guildford, England; and ESYS Limited, Guildford, England Original contains color illustrations
Avail: CASI HC A06/MF A02

The information details the current status and plans for future space missions and how they relate to major international environmental programs. The information was drawn from space agencies and environmental program managers, but at present the missions of the Commonwealth of Independent States (formerly the USSR) were not incorporated. It identifies missions over the next 15 years according to whether they are: (1) firm/approved missions which are flying, in manufacture or to be funded within existing resources; and (2) proposed missions where plans are formulated but which are, as yet, outside existing resources or beyond the normal timescales for approval. The presentation of the information is oriented by measurement rather than mission. Six major categories of measurement were identified: (1) atmospheric dynamics/water and energy cycles; (2) atmospheric chemistry; (3) land; (4) ice and snow; (5) ocean dynamics; and (6) ocean biology. Within these six categories, further subdivisions were made. Author

N92-34027 California Univ., Berkeley.
FOREST SUCCESSION AND CLIMATE CHANGE: COUPLING LAND-SURFACE PROCESSES AND ECOLOGICAL DYNAMICS Ph.D. Thesis
Philippe Martin 1990 358 p
Avail: Univ. Microfilms Order No. DA9126692

Growing evidence supports the hypothesis that humans are in the process of inadvertently modifying the Earth's climate by increasing the atmospheric concentrations of carbon dioxide and other radiatively active trace gas. The present man-induced climate change, often referred to as the greenhouse effect, is different from natural changes because of its unprecedented pace and our incomplete knowledge of its consequences. As some scientists put it, humanity is performing on itself a 'global experiment' which may entail a number of surprises. The potential changes in the behavior of atmosphere/biosphere interactions are of particular importance. Such changes could affect atmospheric dynamics, the local and regional hydrology, the global bio-geochemistry, and therefore, human societies. Five distinct aspects of climate/vegetation interactions are examined. First, the climatically and physiologically mediated impacts of increases in the concentration of carbon dioxide on the evaporation from agricultural crops, grassland, and forests are investigated using the Penman-Monteith combination equation. Second, the degree of coupling between the vegetation and the atmosphere, as defined by Jarvis and McNaughton, is reexamined taking radiative losses from the vegetation to the atmosphere into account. Third, the effects of changes in the mean vs. the variance of climatic variables are investigated using a modified version of the forest dynamics model developed by Pastor and Post, LINK-AGES. Fourth, using the same model, changes in the production of non-methane hydrocarbons are estimated as climate and/or vegetation change. Finally, the main focus is on the response of forests to climatic changes using a model treating the physics of energy and water exchange in detail. Because the Energy, Water, and Momentum Exchange, and Ecological Dynamics Model (EXE), couples the land-surface processes and the ecological dynamics of forests of Northeast America, new insights are gained into the behavior of forests, in general, and into the possible consequences of a greenhouse effect on forest hydrology and vegetation succession, in particular. Dissert. Abstr.

N92-34028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GLOBAL CHANGE DATA SETS: EXCERPTS FROM THE MASTER DIRECTORY, VERSION 2.0
Joy Beier Feb. 1992 220 p
(NASA-TM-107994; NAS 1.15:107994;
NSSDC/WDC-A-R/S-91-34) Avail: CASI HC A10/MF A03

The recent awakening to the reality of human-induced changes to the environment has resulted in an organized effort to promote global change research. The goal of this research as outlined by NASA's Earth System Science Committee (Earth System Science: A closer View, 1988) is to understand the entire Earth system on a global scale by describing how its component parts and their interactions have evolved, how they function, and how they may be expected to evolve on all timescales. The practical result is the capacity to predict that evolution over the next decade to century. Key variables important for the study of global change include external forcing factors (solar radiance, UV flux), radiatively and chemically important trace species (CO2, CH4, N2O, etc.), atmospheric response variables (temperature, pressure, winds), landsurface properties (river run-off, snow cover, albedo, soil moisture, vegetation cover), and oceanic variables (sea surface temperature, sea ice extent, sea level ocean wind stress, currents, chlorophyll, biogeochemical fluxes). The purpose of this document is to identify existing data sets available (both remotely sensed and in situ data) covering some of these variables. This is not intended to be a complete list of global change data, but merely a highlight of what is available. The information was extracted from the Master Directory (MD), an on-line scientific data information service which may be used by any researcher. This report contains the coverage dates for the data sets, sources (satellites, instruments) of the data and where they are archived. Author

N92-34055# Lawrence Livermore National Lab., CA.
EFFECTS OF INCREASING METHANE ON TROPOSPHERIC AND STRATOSPHERIC CHEMISTRY
D. J. Wuebbles, J. S. Tamaresis, and D. E. Kinnison Apr. 1992 26 p Presented at the North Atlantic Treaty Organization Advanced Research Workshop, Mount Hood, OR, 6-11 Oct. 1991
(Contract W-7405-eng-48)
(DE92-017436; UCRL-JC-108376; CONF-9110220-3) Avail: CASI HC A03/MF A01

Methane (CH4) is the most abundant reactive trace gas in the troposphere. Due to its relatively long atmospheric lifetime, CH4 chemistry has an important influence on the global atmosphere, affecting the amount of ozone (O3) in both the troposphere and stratosphere, the amount of hydroxyl (OH) in the troposphere, and the amount of water vapor (H2O) in the stratosphere. Methane oxidation also is an important source of atmospheric carbon monoxide (CO). In addition, CH4 is a greenhouse gas and its increasing concentrations are of interest to concerns about climate change. In this study, we reexamine the effects of increasing CH4 using the LLNL two-dimensional chemical-radiative-transport model. Several papers had previously

examined the effects of a CH4 perturbation in the troposphere and stratosphere, the last being Isaksen and Stordal (1968). Their model uses homogeneous chemistry with older kinetic parameters and does not include dynamic or radiative feedback. We extend their work by including two heterogeneous reactions that occur on background sulfuric acid aerosols. DOE

N92-34058*# Consortium for International Earth Science Information Network, University Center, MI.
PATHWAYS OF UNDERSTANDING: THE INTERACTIONS OF HUMANITY AND GLOBAL ENVIRONMENTAL CHANGE
Harold K. Jacobson, John Katzenberger, Jack Lousma, Harold A. Mooney, Richard H. Moss, William Kuhn, Urs Luterbacher, and Ellen Wiegandt 1992 62 p Original contains color illustrations
(Grants NAGw-2010; NAGw-2901)
(NASA-CR-190678; NAS 1.26:190678) Copyright Avail: CASI HC A04/MF A01; 35 functional color pages

How humans, interacting within social systems, affect and are affected by global change is explored. Recognizing the impact human activities have on the environment and responding to the need to document the interactions among human activities, the Consortium for International Earth Science Information Network (CIESIN) commissioned a group of 12 scientists to develop a framework illustrating the key human systems that contribute to global change. This framework, called the Social Process Diagram, will help natural and social scientists, educators, resource managers and policy makers envision and analyze how human systems interact among themselves and with the natural system. The Social Process Diagram consists of the following blocks that constitute the Diagram's structural framework: (1) fund of knowledge and experience; (2) preferences and expectations; (3) factors of production and technology; (4) population and social structure; (5) economic systems; (6) political systems and institutions; and (7) global scale environmental processes. To demonstrate potential ways the Diagram can be used, this document includes 3 hypothetical scenarios of global change issues: global warming and sea level rise; the environmental impact of human population migration; and energy and the environment. These scenarios demonstrate the Diagram's usefulness for visualizing specific processes that might be studied to evaluate a particular global change issues. The scenario also shows that interesting and unanticipated questions may emerge as links are explored between categories on the Diagram. Author

N92-34068# Oak Ridge National Lab., TN.
ENERGY AND GLOBAL WARMING IMPACTS OF CFC ALTERNATIVE TECHNOLOGIES
S. K. Fischer, P. D. Fairchild, and P. J. Hughes 1992 8 p Presented at the International Inst. of Refrigeration Meeting on Refrigeration, Energy and Environment, Trondheim (Norway), 22-24 Jun. 1992
(Contract DE-AC05-84OR-21400)
(DE92-015128; CONF-9206130-1) Avail: CASI HC A02/MF A01

Chlorofluorocarbons (CFCs) are used in a number of applications, and volumes of CFCs used grew at a tremendous pace during the 1960s and 1970s. However, in the mid-1980s, it was confirmed that these extremely useful chemicals contribute to the destruction of stratospheric ozone. These chemicals are being phased out of use rapidly to protect the ozone layer and it is very important that the replacements for CFCs do not result in a net increase in global warming by introducing less efficient processes that lead to higher energy use and increased carbon dioxide emissions. A study was conducted to identify those alternative chemicals and technologies that could replace CFCs in energy related applications before the year 2000, and to assess the total potential impact of these alternatives on global warming. The analysis for this project included an estimate of the direct effects from the release of blowing agents, refrigerants, and solvents into the atmosphere and the indirect effects in the form of carbon dioxide emissions resulting from energy use for commercial and residential heating and cooling, household and commercial refrigeration, building and automobile air-conditioning, and general metal and electronics solvent cleaning. The discussion in this paper focuses on those aspects of the study relevant to refrigeration and air-conditioning. In general the use of hydrofluorocarbon (HFC) and hydrochlorofluorocarbon (HCFC) alternatives for CFCs lead to large and sometimes dramatic reductions in total equivalent warming impact (TEWI), lifetime equivalent CO2 emissions. Most of the reductions result from decreased direct effects without significant changes in energy use. DOE

N92-34145*# FWG Associates, Inc., Tullahoma, TN.
REMOTE SENSING TECHNOLOGY RESEARCH AND INSTRUMENTATION PLATFORM DESIGN Final Report
20 Aug. 1992 202 p
(Contract NAS5-30936)
(NASA-CR-190606; NAS 1.26:190606) Avail: CASI HC A10/MF A03

An instrumented pallet concept and definition of an aircraft with performance and payload capability to meet NASA's airborne turbulent flux measurement needs for advanced multiple global climate research and field experiments is presented. The report addresses airborne measurement requirements for general circulation model sub-scale parameterization research, specifies instrumentation capable of making these measurements, and describes a preliminary support pallet design. Also, a review of aircraft types and a recommendation of a manned and an unmanned aircraft capable of meeting flux parameterization research needs is given. Author

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N92-33415 York Univ., Downsview (Ontario).
LIDAR MEASUREMENTS OF OPTICAL EXTINCTION IN THE LOWER TROPOSPHERE Ph.D. Thesis
Andrew Grant Cunningham Jun. 1990 337 p
(ISBN-0-315-60958-3; CTN-92-60518) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

The capacity of lidar for making quantitative measurements of optical extinction on the lower troposphere was assessed through an extensive body of lidar data along with simultaneous in situ data obtained through measurements of particle concentration on the atmosphere, and by comparison with atmospheric models developed to represent various lidar-observed atmospheric conditions. Using this dual approach has enabled evaluation of the extent to which lidar can be used as a standalone diagnostic tool to measure the extinction coefficient, to determine general levels of uncertainty in the derived extinction profiles for a variety of atmospheric conditions likely to be encountered, and to indicate the refinement level of current inversion techniques beyond which further improvements are unnecessary or undesirable. The lidar capabilities for making these measurements were demonstrated by the intercomparisons of lidar- and in situ-derived extinction values. Results show that the accuracy of lidar extinction data is at least as good as that derived from in situ data, but lidar is capable of making these measurements with excellent spatial and temporal resolution. The optimum inversion techniques for analysis of lidar soundings are the simpler ones, which are not as accurate as more sophisticated techniques but are simple and reliable for use on an operational basis. Author (CISTI)

N92-33543# Lockheed Missiles and Space Co., Palo Alto, CA. Research Lab.
COMPREHENSIVE MAPPINGS OF ELECTRON PRECIPITATION AND ITS EFFECTS ON THE ATMOSPHERE Annual Technical Report, Jul. 1988 - Jun. 1992

W. L. Imhof, H. D. Voss, J. Mobilia, R. R. Vondrak, and E. E. Gaines Jun. 1992 52 p
(Contract F49620-88-C-0072)
(AD-A252826; LMSC/F247098; AFOSR-92-0731TR) Avail: CASI HC A04/MF A01

Precipitation of energetic electrons is an important energy input to the earth's upper atmosphere and can alter the chemistry and dynamics of that region. The precipitation can be studied on a global basis using a satellite X-ray imager to make maps of the X-rays produced when the electrons stop in the atmosphere. We have used 4-40 keV X-ray data from the S81-1 SEEP satellite instrument to classify the patterns of precipitation at high latitudes; the three principal types are strong auroral arcs in the night side, extended dawnside arcs, and isolated pitches inside the polar cap. We also studied the characteristics of high energy (relativistic) electron precipitation with data from instruments that directly detect the electrons. This very penetrating radiation is important because the electrons deposit their energy down to altitudes as low as ~55 km. This study found that the precipitation was confined to narrow latitude bands, often at the outer boundary of the belt of trapped electrons, and that it occurs more often at midnight local time than at noontime. GRA

N92-33644# Technische Univ., Delft (Netherlands). Sektie Fysische, Meetkundige en Ruimtegeodesie.
ABSOLUTE GRAVITY IN THE NETHERLANDS Thesis [ABSOLUTE ZWAARTEKRACHT IN NEDERLAND]
R. E. vanRee Dec. 1991 105 p In DUTCH
(ETN-92-92031) Avail: CASI HC A06/MF A02

Contributions to the study of absolute gavity in the Netherlands are reported. Theoretical and technical aspects of absolute gravity are described with a view to the preparation and interpretation of the measurements, and with emphasis on the fundamental character of gravity with respect to geodetic observations. In two of the three measurement locations, the measurements were successful, while in the third the noise level was too high and the underground too weak. The comparison with relative gravimeter measurements is satisfactory. Using absolute measurements, repeated over the years, it seems to be possible to make statements concerning regional and local changes in the Earth's crust and motions of the sea level. ESA

N92-33677# Naval Postgraduate School, Monterey, CA.
INVESTIGATION OF A CCD CAMERA FOR MEASUREMENTS OF OPTICAL ATMOSPHERIC TURBULENCE M.S. Thesis
William J. Rall Mar. 1992 88 p
(AD-A252972) Avail: CASI HC A05/MF A01

Atmospheric turbulence introduces random phase distortions in optical imaging systems. The development of new laser and imaging systems requires information on the spatial and temporal distribution of this atmospheric turbulence. Measurements of the image spread and the jitter induced by the atmosphere on an optical system provide two techniques to quantify these phenomena. This thesis evaluates a Spectra Sources Lynxx PC Plus charge coupled device (CCD) array as an atmospheric turbulence sensor. Data acquisition and processing programs were written to measure the image spread of a point source and centroid jitter of a point source imaged through the atmosphere. Since atmospheric jitter measurements require high image frame rates, on the order of 200 images per second, a large portion of this thesis involved measurements of the times for the CCD detector, interface board, and IBM compatible computer to perform their tasks. Recommendations for higher performance are presented. GRA

N92-33689# Karlsruhe Univ. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung.
EXAMINATIONS OF THE FLOW OVER A MICROSCALE OBSTACLE IN THE ATMOSPHERE Thesis [UNTERSUCHUNGEN ZUR UEBERSTROEMUNG EINES MIKROSKALIGEN HINDERNISSES IN DER ATMOSPHAERE]
Klaus Heldt Jul. 1991 103 p In GERMAN
(Rept-14; ETN-92-91911) Avail: CASI HC A06/MF A02

Measurements of the mean flow and of the turbulence of the atmospheric boundary layer at the overflow of a high tide dam were carried out. In addition to the mean profiles of wind velocity, temperature and humidity, the instantaneous values of the turbulent fluctuations of wind velocity and of the temperature over the dam were registered. The examination of the fluctuations of the three dimensional rotation vector showed an accumulation in the forward direction, with low elevation angle. The arrangement of the turbulence measuring instruments allowed the derivation in two space directions and in the time, so that the velocity dyad could be determined using the Taylor hypothesis. ESA

N92-33741*# Lockheed Missiles and Space Co., Palo Alto, CA. Research Lab.
ORIGINS OF ENERGETIC IONS IN THE EARTH'S MAGNETOSHEATH Final Report, 8 May 1991 - 5 Jun. 1992
S. A. Fuselter, E. G. Shelley, and D. M. Klumpar 5 Jun. 1992 138 p
(Contract NAS5-31213)
(NASA-CR-189278; NAS 1.26:189278) Avail: CASI HC A07/MF A02

The analysis and interpretation of the combined scientific data from the Hot Plasma Composition Experiment (HPCE) and the Charge Energy Mass (CHEM) spectrometer on the Active Mesospheric Particle Tracer Experiment (AMPTE) Charge Composition Explorer (CCE) spacecraft are discussed. These combined data sets have and will be used to survey the energetic ion environment in the Earth's magnetosheath to determine the origins and relative strengths of the energetic ion populations found there. A computer code was developed to analyze and interpret the data sets. The focus of the first year was on the determination of the contribution of leaked magnetospheric protons to the total energetic proton population. Emphasis was placed on intervals when the AMPTE spacecraft was in the plasma depletion layer because it was argued that in this region, only the leaked population contributes to the energetic ion population. Manipulation of the CHEM data and comparison of the CHEM and HPCE data over their common energy range near the magnetopause also contributed directly to a second study of that region. Author

N92-33803# Bureau of Mines, Minneapolis, MN.
BOMCRATR: A CURVED RAY TOMOGRAPHIC COMPUTER PROGRAM FOR GEOPHYSICAL APPLICATIONS Report, 1992
D. R. Tweeton, M. J. Jackson, and K. S. Roessler 1992 47 p
(PB92-193416; BUMINES-RI-9411; LC-92-7388) Avail: CASI HC A03/MF A01

The U.S. Bureau of Mines has developed tomographic computer programs for geophysical applications. The programs were developed for predicting and monitoring the flow pattern of leach solution during in situ mining. The Bureau has also applied them to assessing high-wall blast damage and examining the integrity of mine-related geological structures. The report describes the curved ray program BOMCRATR (Bureau of Mines curved ray tomographic reconstruction), tells how to run it, and gives examples with synthetic and field data. BOMCRATR provides optional mathematical constraints to counteract the nonuniqueness of tomographic reconstructions with crosshole data. These constraints include limiting the maximum and minimum velocities, fixing the velocity at any point to any value, and establishing layers in which velocity does not vary with horizontal position. The user can test for nonuniqueness by varying the initial velocity pattern. The program can perform either curved or straight ray analysis. Ray paths are calculated analytically in triangular pixels, which is faster than incremental numerical approximations. Author

N92-33830# European Space Agency, Paris (France).
LIMB SOUNDING TECHNIQUES FOR ENVIRONMENTAL MONITORING IN THE NINETIES
T.-D. Guyenne, ed. Feb. 1992 55 p
(ESA-SP-1140; ISBN-92-9092-136-6; ETN-92-91973) Copyright Avail: CASI HC A04/MF A01

A review on limb sounding techniques for environmental monitoring of the middle atmosphere is presented. Scientific

requirements are outlined and the relative merits of the various methods for studying chemical processes in the atmosphere from space are considered. A survey of the electromagnetic spectrum, identifying the species that can be targeted in each region, is given. The various instrumental possibilities are surveyed and a series of technical and scientific recommendations is made. In particular, the latter highlights the importance of the ground segment and the need to ensure that hardware provisions are matched by the analysis programs. ESA

N92-33846 Missouri Univ., Columbia.
PLANETARY WAVE ACTIVITIES AND ENERGETICS IN THE NORTHERN HEMISPHERE WINTER CIRCULATION Ph.D. Thesis
Carlos C. Dacamara 1991 116 p
Avail: Univ. Microfilms Order No. DA9133583

A systematic analysis of planetary wave activities is performed over 3-month winter periods from 1956 to 1989. Winter months are grouped into 5 categories of circulation patterns, according to blocking activity during the month. The large-scale characteristics of circulation patterns are compared by analyzing the statistics from energetic related parameters. Differences among categories are apparent in amplitude and kinetic energy of zonal wavenumber one, nonlinear interactions among planetary waves, and sea surface temperature (SST) anomalies in the Pacific and Atlantic. Differences may result from internal dynamical processes and slow changes in external forcing. Differences in distribution of winter months among categories were apparent during the three subperiods 1956-1966, 1967-1978 and 1979-1989. Time series of amplitudes and kinetic energy of planetary waves and first principal components of SST indicate visible differences among the subperiods. Differences were also found in SST anomalies on the Pacific and Atlantic. These results seem to provide evidence of climatological variation at approximately a ten-year interval.
Dissert. Abstr.

N92-33848 East Anglia Univ., Norwich (England).
A STATISTICAL-DYNAMICAL CLIMATE MODEL APPLIED TO TRACE GAS TRANSPORT AND CHEMISTRY IN THE TROPOSPHERE Ph.D. Thesis
Michael John Follows 1990 240 p
Avail: Univ. Microfilms Order No. BRDX93446

A zonally averaged statistical-dynamical climate model, representing a single hemisphere from 1000 to 240 mb, is used to provide a mean circulation and eddy transfer coefficients for trace gas transport experiments. The annual mean model is highly parameterized for relevant physical processes. The model is first adapted for seasonally varying climate integrations, which fail catastrophically. A positive feedback mechanism between Hadley Cell and latent heating is found to be responsible and averted by the addition of tropical eddy transfers of water vapor. Though stabilized, the model's seasonal temperature variation is extreme. Exploratory integrations reveal a tendency for the model's component radiation fields to mutually adjust to preserve an unrealistic net radiation distribution, and so too, temperature. A simple two box, energy balance model is considered to establish the mechanism. This temperature feedback in a freely responding, highly parameterized model implies such features may also be hidden in more specified models. The annual gross exchange rate of air between stratosphere and troposphere in the Northern Hemisphere is estimated to be 2.5(+ or - 2) x 10 (exp 17) kg year(exp -1) from trace gas budgets. Assuming a tropopause folding mechanism for the exchange, this flux is distributed with latitude and time to give an upper boundary condition for the trace gas transport model. Annual mean and seasonal experiments concerning the transfer of stratospheric ozone to the troposphere, and its subsequent fate, are performed with the zonally averaged model. A hypothetical troposphere with no potential for photochemical ozone formation is considered. The sinks of ozone represented are surface deposition and a photochemical sink through photolysis, and subsequent reaction of singlet oxygen with water vapor. The net annual flux of ozone from stratosphere to troposphere, for this system, is estimated to be 1.7 x 10(exp 11) kg.
Dissert. Abstr.

N92-33956 Pennsylvania State Univ., University Park.
ION LAYERS, TIDES, GRAVITY WAVES, AND ELECTRIC FIELDS IN THE UPPER ATMOSPHERE, INFERRED FROM ARECIBO INCOHERENT SCATTER RADAR MEASUREMENTS Ph.D. Thesis
Yu Tong Morton 1991 206 p
Avail: Univ. Microfilms Order No. DA9204258

This thesis uses data accumulated during 1980-1989 by the Arecibo incoherent scatter radar to study the behavior and physics of ionization irregularities. Low latitude ionization irregularities, known as sporadic-E and intermediate layers, undergo a regular daily descent, convergence, and dumping of ion layers controlled by the neutral tidal wind. A useful way of studying ion layers and their motion is by ion layer trajectory maps which consist of points representing the altitude and time of ionization layers. Two types of maps were used which assigned either a uniform layer intensity or a gray level/pseudo-color to indicate different layer intensities. Each has its own advantages and are often used together. Important aspects of layer formation are revealed by map analysis. During January, intermediate layers consistently appeared four times per day instead of the normal twice per day pattern. Simulation of ion trajectories based on the ion momentum equation, which includes both Lorentzian and collisional forces, shows that a combination of diurnal, semidiurnal, and six-hour tides is necessary for such a feature to exist, whereas only diurnal and semidiurnal tides are needed to create the normal pattern. The six-hour period tide has not been previously reported. Extra or irregular layers appear frequently in layer trajectory maps, which can be simulated by the addition of gravity waves to the regular tidal wind system. Ion layer trajectory maps can indicate gravity wave activity in the upper atmosphere. Electric field effects are normally not a factor in low latitude ion layer formation because they are relatively weak and not commonly observed. Layer configurations during a geomagnetic storm, however, indicate that the electric field played an important role in controlling ion motion. This is supported by an ion trajectory simulation in which a normal tidal wind field and electric field are both active. The simulation shows that an electric field which points northeast, having a magnitude of a few mV/m, can drive ions upward out of the E region. The magnitude and direction of this nighttime electric field agree with F region drift measurements performed in the low latitude during disturbed conditions.
Dissert. Abstr.

N92-33957 Cornell Univ., Ithaca, NY.
CHIRPED INCOHERENT SCATTER RADAR OBSERVATIONS OF THE HF-MODIFIED IONOSPHERE Ph.D. Thesis
Brett Cameron Isham 1991 272 p
Avail: Univ. Microfilms Order No. DA9204031

High power high frequency (HF) radio wave modification experiments were conducted in the ionosphere above Arecibo in 1986, 1987, and 1988 and observed using chirped incoherent scatter radar diagnostics. The heating duty cycle was normally 30-s-on/30-s-off, although the on and off times were occasionally varied and CW was used during one experiment. The data show that the observations of Muldrew and Showen (1977) and of Birkmayer et al. (1986), which suggest that heater enhanced waves are trapped inside plasma density depletions located near the O mode cutoff, can be readily duplicated under typical ionospheric conditions above Arecibo. High time resolution (5 ms) observations indicate that the HF line appears at the O mode cutoff within 20 ms of heater turn-on with no subsequent development in height. Simultaneous daytime chirped and unchirped observations show the existence of additional layers of excited waves located between 1 and 3 km below the usual region and normally appearing about 10 s after heater turn-on. The appearance of these new layers may be associated with the creation of a new resonance at the height where the heating frequency f sub hf equals the upper hybrid frequency. Nighttime observations also show several layers of enhanced plasma lines spread over a 3-km height range below the matching height. This phenomena appears to depend strongly

on the incident HF heating power. Other modifications due to heating have been observed via broadening of the natural line, caused by the growth of 100-m-diameter field aligned striations, and through changes in the natural line frequency, caused by increases in the ambient electron temperature. Results from a 1986 heating experiment performed at EISCAT indicate the presence of multiple enhanced lines offset up to 10 km in altitude below X = 1 and 270 kHz in frequency above f sub hf. Due to high Landau damping, the usual HF line and the natural plasma line were not observed. During the experiment, a topside enhanced region was formed by HF waves propagating in the Z mode. Implications of these results for current theories of heating are discussed, and specific further observations are recommended.
Dissert. Abstr.

N92-33958 California Univ., Berkeley.
A STUDY OF THE TERRESTRIAL THERMOSPHERE BY REMOTE SENSING OF OI DAYGLOW IN THE FAR AND EXTREME ULTRAVIOLET Ph.D. Thesis
Daniel Murdoch Cotton 1991 153 p
Avail: Univ. Microfilms Order No. DA9203535

The upper region of the Earth's atmosphere, the thermosphere, is a key part of the coupled solar-terrestrial system. An important method of obtaining information in this region is through analysis of radiation excited through the interactions of the thermosphere with solar ionizing, extreme and far ultraviolet radiation. This dissertation presents one such study by the remote sensing of OI in the far and extreme ultraviolet dayglow. The research program included the development, construction, and flight of a sounding rocket spectrometer to test our current understanding of the excitation and transport mechanisms of the OI 1356, 1304, 1027, and 989 A emissions. The instrument collected data in two band passes (980-1040 A and 1300-1360 A) at about 1.5 A resolution on September 30, 1988. The observations include viewing angles between 95 and 125 degrees from zenith and altitudes from 165 to 960 km. The resolution was sufficient to separate the 1304 A triplet for the first time for this altitude and look direction coverage. This data set was analyzed using current electron and radiative transport models with the purpose of checking the viability of OI remote sensing; that is, whether existing models and input parameters are adequate to predict these detailed measurements. The attention was focused upon the input parameters which consist of atmospheric composition, temperature, energy input (solar extreme ultraviolet), excitation cross sections, transitions probabilities, and branching ratios. From discrepancies between modeled and measured emissions, inferences about these input parameters were made. Among other things, the data supports a 40 percent optically thick cascade contribution to the 1304 A emission. From upper lying states corresponding to 1040, 1027, and 989 A about half of this cascade has been accounted for in this study. There is also evidence that the Lyman B airglow from the geocorona contributes a significant proportion (30-50 percent) to the OI 1027 A feature. Furthermore, the photoelectron contribution to the 1027 A feature appears to be underestimated in the current models by a factor of 20. Finally, based on the discrepancies between the modeled and the measured intensities, the model was modified to take into account possible effects due to exospheric conditions. In particular, a modeled ground state OI P-3 sub 2,1,0 sub-level populations were included for collisionless atmosphere as well as hot O geocorona. The results imply that this data set provides the first direct evidence of a terrestrial hot O geocorona.
Dissert. Abstr.

N92-33974# Sandia National Labs., Albuquerque, NM.
AN EXPERIMENT TO INVESTIGATE THE ISOPLANATIC ANGLE OF THE ATMOSPHERE IN THE NEAR INFRARED
D. R. Neal, R. B. Michie (Mission Research Corp., Albuquerque, NM.), J. Drummond (Phillips Lab., Kirkland AFB, NM.), D. McCarthy (Arizona Univ., Tucson.), and T. Stewart McKechnie (POD Associates, Inc., Albuquerque, NM.) 1992 4 p Presented at the Nonlinear Optics: Materials, Fundamentals, and Applications, Maui, HI, 17-21 Aug. 1992
(Contract DE-AC04-76DP-00789)
(DE92-010402; SAND-92-0599C; CONF-920853-2) Avail: CASI HC A01/MF A01

Recently there has been considerable discussion of the properties of atmospheric turbulence. The size of the outer scale (L(sub 0)), and the scaling of the isoplanatic angle with wavelength have been questioned. We have measured the atmospheric isoplanatic angle in the near infrared by correlating widely separated time-resolved stellar images.
DOE

N92-34026 Colorado State Univ., Fort Collins.
HEAVY-PARTICLE DEPOSITION IN THE ATMOSPHERIC BOUNDARY LAYER Ph.D. Thesis
Yingcheng Liao 1991 154 p
Avail: Univ. Microfilms Order No. DA9134459

A set of experiments of heavy-particle deposition on the ground in a wind-tunnel simulated atmospheric boundary layer was conducted. Different particle fall velocities and different wind speeds were used. In order to analyze inertial, continuity, and crossing-trajectories effects of heavy particles, a new random-walk model was developed in which vertical velocity variance is a function of height. For calibration of the numerical model, a set of tracer-gas concentration measurements was also carried out. The analysis of experimental results reveals that, in the atmospheric surface layer, for most of the practical situations, the crossing-trajectories and the inertia of heavy particles have a very limited effect on heavy-particle dispersion and deposition. However, the continuity effect greatly affects the lateral dispersion and deposition of heavy particles. The continuity effect is strongly height dependent. Influences of different factors on heavy-particle deposition are discussed. This includes the fall-velocity distribution of heavy particles, the integral-time scales of turbulent flow, longitudinal turbulent velocity components, release height, etc. Comparisons between the theoretical prediction and the calculated results from both the model used in this study and the model of Legg and Raupach (1982) support the author's approach in which vertical velocity variance is taken to be height dependent. For practical purposes, the new random-walk model has greatly improved the accuracy of predicting longitudinal deposition of heavy particles compared to that of the traditional Gaussian model. Experiments with more release heights and larger differences of particle fall velocity are suggested in order to further confirm the findings.
Dissert. Abstr.

N92-34045 Oxford Univ. (England).
SATELLITE SOUNDING OF TROPOSPHERIC TEMPERATURE AND HUMIDITY Ph.D. Thesis
A. P. McNally 1990 242 p
Avail: Univ. Microfilms Order No. BRD-93064

Two methods for retrieving atmospheric products from TOVS (TIROS Operational Vertical Sounder) satellite data are investigated. The first is a linear scheme used operationally by the U.K. Meteorological Office to obtain profiles of temperature and humidity from cloud-cleared radiance data. The second is a nonlinear iterative scheme operating on potentially cloud contaminated raw measurements which is currently being considered for future operational implementation at the Meteorological Office. The results of simulated and real data experiments aimed at investigating and improving the performance of both schemes are presented and discussed. Some comparisons between the performance of the two schemes under similar conditions are also made. Significant improvements are obtained in several areas, mainly in the specification of measurement and forecast error characteristics and (for the nonlinear scheme) in the treatment of cloud effects.
Dissert. Abstr.

N92-34047 Oklahoma Univ., Norman.
DUAL DOPPLER MEASUREMENT OF A SHEARED, CONVECTIVE BOUNDARY LAYER Ph.D. Thesis
Jeanne Maples Schneider 1991 143 p
Avail: Univ. Microfilms Order No. DA9128656

The Phoenix 2 experiment was conducted in the spring of 1984 on the high plains of eastern Colorado, using dual Doppler

radar as the primary observing tool in a study of the convective planetary boundary layer. Extensive support was provided by in situ sensors (instrumented aircraft, micrometeorological tower and surface network) for verification and extension of radar data. The two experiment days with the deepest boundary layers (which proved to be strongly sheared) were chosen for intensive study, and six 20-minute segments of continuous data from each day (about one each hour during the afternoon) were analyzed. The time resolution of the data is approximately two minutes, and the resolution of the analysis grid (which is 9 km by 9 km by 4 km deep) is 200 m in all directions. Application of available dual Doppler synthesis and integration techniques to define the four-dimensional velocity fields produced an unacceptably high noise level in the vertical velocity and derived statistics, prompting an exploration of alternative analysis methods, and a revival of coplanar integration to reduce the error variance to an acceptable level. The success of the coplanar technique is also demonstrated in a propagation of error analysis. Pressure and buoyancy fluctuations were retrieved from the wind fields using the Gal-Chen/Hane thermodynamic recovery, although over a smaller range of physical scales. The computed momentum and buoyancy fluxes are the basis of a study of the sheared, convective boundary layer over the course of two afternoons, including turbulent kinetic energy budgets and vertical velocity variance budgets. Dissert. Abstr.

N92-34048 Oklahoma Univ., Norman.
RETRIEVAL OF VIRTUAL TEMPERATURE FROM VERTICAL WIND PROFILES AND GROUND-BASED MICROWAVE RADIOMETER DATA Ph.D. Thesis
Meta Elizabeth Sienkiewicz 1991 351 p
Avail: Univ. Microfilms Order No. DA9128674

Measurements of a wind field and its changes with time (such as may be made by a network of wind profilers) provide information that may be used, along with the equations of motion and the hydrostatic relation, to retrieve analyses of virtual temperature. Such analyses are poor near the surface where boundary layer sub-grid scale processes dominate, but improve in the mid-layers of the atmosphere. Radiometric measurements such as may be made by ground based (and satellite) microwave radiometers also provide information about temperature fields, and temperature profiles retrieved from the ground-based radiances are fairly good near the surface but become poorer further from the ground. In this study, we want to find whether an analysis derived from a combination of wind and radiometric data can improve on analyses derived from either data source alone. This hypothesis is tested using rawinsonde data taken during a special field experiment (AVE-VAS). Temperature fields are derived from radiosonde wind observations taken at three-hourly intervals. These temperature analyses are combined with ground-based radiances (calculated from radiosonde temperature profiles) and the combined analyses are compared to analyses derived from winds and from radiances alone. Several retrieval methods using radiances and radiance gradients are evaluated. The results show that the temperature analyses from the wind data are improved by the addition of ground-based radiances although there is little effect above 700 mb where the weighting functions of the radiances are small.
Dissert. Abstr.

N92-34062 Minnesota Univ., Minneapolis.
EXPERIMENTAL STUDIES OF GAS-AEROSOL REACTIONS Ph.D. Thesis
Anand Gupta 1991 209 p
Avail: Univ. Microfilms Order No. DA9127734

The aqueous phase oxidation of SO2 by H2O2 is believed to the principle mechanism for atmospheric sulfate formation in cloud droplets. However, no studies in noncloud aerosol systems have been reported. The objective is to quantify the importance of the noncloud liquid phase reactions of SO2 by H2O2 in the atmosphere. Growth rates of submicron droplets exposed to SO2 and H2O2 were measured using the tandem differential mobility analyzer (TDMA) technique (Rader and McMurry, 1986). The technique uses differential mobility analyzers (DMA's) to generate monodisperse particles and to measure particle size after the reaction. To facilitate submicron monodisperse droplet production with the DMA, a low-ion-concentration charter capable of generating singly charged particles up to 1.0 microns was developed and experimentally evaluated. The experiments were performed using dry and deliquesced (NH4)2SO4 particles with SO2 and H2O2 concentrations from 0-860 ppb and 0-150 ppb, respectively. No growth was observed for dry particles. For droplets greater than or equal to 0.3 microns, the fractional diameter growth was independent of particle size and for droplets less than or equal to 0.2 microns, it decreased as particle size decreased. The observed decrease is due to NH3 evaporation. As ammonia evaporates, droplet pH decreases causing the oxidation rate to decrease, leading to a lower growth rate. To predict the size-dependent growth rates, a theoretical model was developed using solution thermodynamics, gas/particle equilibrium, and chemical kinetics. The experimental and theoretical results are in reasonable agreement. For dry (NH4)2SO4 particles exposed to SO2, H2O2, NH3, and H2O vapor, surface reaction-controlled growth was observed. Particle growth was very sensitive to particle composition. No growth was observed for Polystyrene latex particles, whereas (NH4)2SO4 particles doped with catalysts (Fe(2+), Fe(3+), Mn(2+) and Cu(2+)) in a molar ratio of 1:500 grew slower than pure (NH4)2SO4 particles. The chemical mechanism for these surface reactions remains to be elucidated. Observed growth rates extrapolated to ambient SO2 and H2O2 concentrations are 10 to 100 times smaller than those observed by McMurry and Wilson (1983) for ambient aerosols. Thus, some other transformation process must be responsible for observed atmospheric rates.
Dissert. Abstr.

N92-34095*# Wisconsin Univ., Madison. Cooperative Inst. for Meteorological Satellite Studies.
DETERMINATION OF ATMOSPHERIC MOISTURE STRUCTURE AND INFRARED COOLING RATES FROM HIGH RESOLUTION MAMS RADIANCE DATA Final Report, 7 Nov. 1986 - 18 Sep. 1991
W. Paul Menzel, Christopher C. Moeller, and William L. Smith
Dec. 1991 179 p
(Contract NAS8-36169)
(NASA-CR-184375; NAS 1.26:184375) Avail: CASI HC A09/MF A02

This program has applied Multispectral Atmospheric Mapping Sensor (MAMS) high resolution data to the problem of monitoring atmospheric quantities of moisture and radiative flux at small spatial scales. MAMS, with 100-m horizontal resolution in its four infrared channels, was developed to study small scale atmospheric moisture and surface thermal variability, especially as related to the development of clouds, precipitation, and severe storms. High-resolution Interferometer Sounder (HIS) data has been used to develop a high spectral resolution retrieval algorithm for producing vertical profiles of atmospheric temperature and moisture. The results of this program are summarized and a list of publications resulting from this contract is presented. Selected publications are attached as an appendix. For individual titles, see N92-34096 through N92-34098.

N92-34096*# Wisconsin Univ., Madison.
SPECTROSCOPIC INFERENCES FROM HIS MEASUREMENTS OF ATMOSPHERIC THERMAL EMISSION
H. E. Revercomb, R. O. Knuteson, W. L. Smith, H. M. Woolf (National Oceanic and Atmospheric Administration, Madison, WI.), and H. B. Howell (National Oceanic and Atmospheric Administration, Madison, WI.) *In its* Determination of Atmospheric Moisture Structure and Infrared Cooling Rates from High Resolution MAMS Radiance Data Dec. 1991 4 p (For primary document see N92-34095 24-46)
Avail: CASI HC A01/MF A02

Radiometrically accurate observations of the earth's emission spectrum from 3.8 to 16.6 microns have been made using the High-resolution Interferometer Sounder (HIS) to look downward from the NASA U2/ER2 aircraft or upward from the ground. These observations have been used to demonstrate the substantially improved vertical resolution of temperature and water vapor

soundings derived from high resolution spectra (resolving power from 1800 to 3800), as compared to soundings from the low resolution filter radiometer observations used in current satellite sounders. The HIS observations have also demonstrated that Fourier Transform Infrared (FTIR) instruments are especially well suited to absolute emission measurements of broad spectral bands at high resolution. A fundamental advantage of FTIR instruments for accurate calibration is wavelength integrity, the same property which has made FTIR the standard for very high resolution absorption measurements. The long wavelength part of a HIS downwelling radiance spectrum is compared to a calculated spectrum. The calculation uses the AFGL HITRAN/86 line file and FASCOD2 line-by-line program with atmospheric state data from in situ measurements. In general, agreement between HIS and FASCOD2 spectra is remarkably good, a tribute to the current state of spectral line files and line-by-line codes. Reproducible differences between HIS observations and FASCOD2 line-by-line calculations lead to the following conclusions: (1) The FASCOD2 water vapor continuum in the longwave window region from 10 to 13 microns (750 to 1000 cm(exp -1)) gives reasonable agreement with radiance observations; (2) The model H2O continuum from 7 to 8 microns (1250 to 1425 cm(exp -2)) needs adjustment to reduce its contribution by about 60 percent; (3) CO2 absorption in the region from 13.1 to 14.3 microns (700 to 760 cm(exp -1)) is too small in the model; and (4) Water vapor line strengths in the region from 8.1 to 9.1 microns (1100 to 1230 cm(exp -1)) need to be increased about 30 percent. M.G.

N92-34097*# Wisconsin Univ., Madison.
THEORETICAL COMPUTATION OF TRACE GASES RETRIEVAL RANDOM ERROR FROM MEASUREMENTS OF HIGH SPECTRAL RESOLUTION INFRARED SOUNDER
Hung-Lung Huang, William L. Smith, Harold M. Woolf, and J. M. Theriault (Defence Research Establishment Valcartier, Quebec) *In its* Determination of Atmospheric Moisture Structure and Infrared Cooling Rates from High Resolution MAMS Radiance Data Dec. 1991 3 p (For primary document see N92-34095 24-46)
Avail: CASI HC A01/MF A02

The purpose of this paper is to demonstrate the trace gas profiling capabilities of future passive high spectral resolution (1 cm(exp -1) or better) infrared (600 to 2700 cm(exp -1)) satellite tropospheric sounders. These sounders, such as the grating spectrometer, Atmospheric InfRared Sounders (AIRS) (Chahine et al., 1990) and the interferometer, GOES High Resolution Interferometer Sounder (GHIS), (Smith et al., 1991) can provide these unique infrared spectra which enable us to conduct this analysis. In this calculation only the total random retrieval error component is presented. The systematic error components contributed by the forward and inverse model error are not considered (subject of further studies). The total random errors, which are composed of null space error (vertical resolution component error) and measurement error (instrument noise component error), are computed by assuming one wavenumber spectral resolution with wavenumber span from 1100 cm(exp -1) to 2300 cm(exp -1) (the band 600 cm(exp -1) to 1100 cm(exp -1) is not used since there is no major absorption of our three gases here) and measurement noise of 0.25 degree at reference temperature of 260 degree K. Temperature, water vapor, ozone and mixing ratio profiles of nitrous oxide, carbon monoxide and methane are taken from 1976 US Standard Atmosphere conditions (a FASCODE model). Covariance matrices of the gases are 'subjectively' generated by assuming 50 percent standard deviation of gaussian perturbation with respect to their US Standard model profiles. Minimum information and maximum likelihood retrieval solutions are used. Author

N92-34098*# Wisconsin Univ., Madison.
HIGH RESOLUTION ATMOSPHERIC AND SURFACE VARIABILITY FROM COMBINED MAMS AND VAS RADIANCES
Christopher C. Moeller, W. Paul Menzel (National Oceanic and Atmospheric Administration, Madison, WI.), and Kathleen I. Strabala *In its* Determination of Atmospheric Moisture Structure and Infrared Cooling Rates from High Resolution MAMS Radiance Data Dec. 1991 13 p (For primary document see N92-34095 24-46)
Avail: CASI HC A03/MF A02

Measuring of the variation of atmospheric and surface quantities such as moisture and stability at small scales is an important step to monitoring, understanding and forecasting mesoscale processes. For instance, moisture and stability products from the geostationary platform VISSR Atmospheric Sounder (VAS) exhibit interesting detail at the meso B (20-200 km) level (Chesters et al., 1986; Smith et al., 1985). However, variations at the meso C scale (2-20 km) and at the lower end of the meso B scale (20-100 km) suffer from the effects of noise. Noise can be greatly reduced by using a high resolution data collection system. The Multispectral Atmospheric Mapping Sensor (MAMS), with its 100-m resolution over a 36km swath, is well suited to provide high resolution mesoscale information about the atmosphere and surface of the earth. A more complete depiction of the atmospheric state at the smaller scales is possible through the combination of the high horizontal resolution MAMS data with the vertical sounding data of the VAS. This paper demonstrates a procedure for combining MAMS and VAS data in a physical retrieval to produce high resolution derived products of precipitable water (PW), lifted index (LI), and skin temperature (TS). The variability of these products is evaluated in a structure function analysis similar to that of Hillger and Vonder Haar (1979). Results for 19 June 1986 from the Cooperative Hunstville Meteorological Experiment (COHMEX) are presented. M.G.

N92-34099*# National Aeronautics and Space Administration, Washington, DC.
NASA UPPER ATMOSPHERE RESEARCH PROGRAM: RESEARCH SUMMARIES, 1990 - 1991. REPORT TO THE CONGRESS AND THE ENVIRONMENTAL PROTECTION AGENCY
Jan. 1992 333 p
(NASA-TM-107987; NAS 1.15:107987) Avail: CASI HC A15/MF A03

The objectives, status, and accomplishments of the research tasks supported under the NASA Upper Atmosphere Research Program (UARP) are presented. The topics covered include the following: balloon-borne in situ measurements; balloon-borne remote measurements; ground-based measurements; aircraft-borne measurements; rocket-borne measurements; instrument development; reaction kinetics and photochemistry; spectroscopy; stratospheric dynamics and related analysis; stratospheric chemistry, analysis, and related modeling; and global chemical modeling. Author

N92-34122# Wright Lab., Wright-Patterson AFB, OH.
ELEVEN YEARS OF IONOSPHERIC SCINTILLATION FADING DATA FROM TWENTY GREENLANDIC STATIONS: APPENDICES Final Report, Jan. 1980 - Jan. 1990
Allen L. Johnson May 1992 434 p
(AD-A253145; WL-TR-92-1051) Avail: CASI HC A19/MF A04

Radio communications in the polar region are subject to periodic outages due to rapid density fluctuations in the Arctic ionosphere. In order to evaluate the effect of solar activity on these outages, the messages from an extensive network of unmanned automatic meteorological stations in Greenland were recorded. In a joint project between the Danish Meteorological Institute and the U.S. Air Force Wright Laboratory, the recorded data were reduced and analyzed to derive bit-error-rate and missed message statistics. These data are summarized in hourly, daily, monthly, and yearly plots for 20 mid-latitude, auroral, and polar stations around Greenland. This report contains the Appendices with 100 station years of data. A description of the experiment and data analysis is contained in WL-TR-92-1050. GRA

N92-34187# Bochum Univ. (Germany, F.R.).
ADVANCED WAVEFORM RESEARCH METHODS FOR GERESS RECORDINGS
H. P. Harjes, N. Gestermann, M. Jost, J. Schweitzer, and J. Wuster 15 Apr. 1992 148 p

(Grant AF-AFOSR-0189-90)
(AD-A253686; PL-TR-91-2142; AD-E201107; SR-2) Avail: CASI HC A07/MF A01

The GERESS array project is a cooperative research program, jointly undertaken by Southern Methodist University and Ruhr-University Bochum in Germany. It is part of a multi-array network which includes NORESS, ARCESS, and FINESA in Scandinavia. This report summarizes research activities carried out at the data center in the Institute of Geophysics in Bochum during 1991. The GERESS array became fully operational in January 1991. Data are continuously transmitted from the array hub in Bavaria to NORSAR and to Bochum via 64 kbit lines. In Bochum, an experimental on-line processing system, based on RONAPP, is operated to monitor data quality and initiate necessary maintenance activities. Since Jul. 1991, the on-site maintenance of the array is also overtaken by Ruhr-University as part of the research grant. The monthly uptime of the array varied between 88.4 percent and 99.7 percent with an average of 94.9 percent. At the data center in Bochum, an automatic event bulletin--interactively reviewed by an analyst--is produced and widely distributed to interested institutions. After one year of operation it is found that GERESS is the most sensitive station in Central Europe for monitoring local, regional, and teleseismic seismicity. During the GSETT-2 experiment, which was conducted by the Geneva experts group during the time period from 22 Apr. - 2 Jun. 1991, GERESS located on average 16 regional events and detected 12 teleseismic events daily. Within the 6 weeks of GSETT-2, GERESS reported 3275 phases to the international data centers. Following a similar study at NORSAR, an evaluation of the P-wave detectability was undertaken for GERESS. GRA

N92-34188# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
AEROSOL OPTICAL PROPERTIES OF THE FREE TROPOSPHERE
James M. Rosen 16 Dec. 1991 24 p
(Contract F19628-90-K-0011)
(AD-A253687; PL-TR-92-2037; AD-E201114; SR-2) Avail: CASI HC A02/MF A01

Nearly simultaneous measurements of the physical and optical properties of boundary layer and free tropospheric aerosols near Boulder, Colorado were made on several occasions using aircraft, balloon, and ground based sensors. This effort was conducted with the purpose of obtaining a diverse, self-consistent data set that could be used for testing optical model calculations based on measured physical characteristics such as apparent size distribution, composition, and shape. Support under this grant made it possible to perform a detailed analysis of this unique data set. It was found that even with the uncertainties involved, the model predictions are in good agreement with the measurements in the visible and near infrared wavelength regions. The results also indicate that during the measurement period the aerosol in the boundary layer and free troposphere behaved as spherical particles for optical modeling purposes. The utility of the observation for determining the extinction-to-backscatter ratio relevant to aerosols in the boundary layer and free troposphere is described with typical measured values being in the 20 to 30 sr range. Further data sets and analysis of this type will be made possible by using the specialized instrumentation developed at the University of Wyoming during the last year. GRA

N92-34189# Tel-Aviv Univ. (Israel).
AN EMPIRICAL MODEL OF FUV AURORAL INTENSITY Final Report, Mar. 1990 - Feb. 1992
Moshe Tur and Israel Oznovich 25 Feb. 1992 36 p
(Contract F49620-90-C-0018)
(AD-A253688; PL-TR-92-2133; AD-E201117) Avail: CASI HC A03/MF A01

A statistical model of auroral intensity as a function of magnetic activity was created. The model was derived from several hundred 1356A images of the aurora borealis obtained by Polar BEAR at solar minimum. Intensities were averaged in 35 divisions of CGL (from 55 deg to 90 deg, each division 1 deg long), 48 divisions of MLT (each division half an hour wide), and 5 divisions of magnetic activity (K(sub p) = 0-4). The peak oval intensity is located near midnight for all K sub p values but 0. Two secondary maxima in the average 1356A intensity are found in the dayside part of the oval: one in morning and one in the afternoon. The peak nightside, morning, and afternoon intensity increase monotonically with magnetic activity. The latitude of peak emission increases with K(sub p) at night and decreases in the dayside. The latitudinal extent of the oval is largest at or near the intensity peaks and increases with magnetic activity. The model of average auroral intensity was related to a statistical model of electron precipitation into the high-latitude ionosphere. The precipitation data leading to auroral emissions show a power law relationship between the energy flux and the average energy of the precipitation electrons. The average electron energy associated with the peak 1356A oval emission is 0.8-1.7 keV at night, predominantly 0.3-0.7 keV in the morning, and predominantly 0.2-0.5 keV in the afternoon. Polar cap emissions are associated with very cold electrons (0.3-0.4 keV). GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N92-33275# Naval Health Research Center, San Diego, CA.
WIND SPEED AND MOISTURE SENSITIVITY TESTS OF THE NRL LIMITED AREA DYNAMICAL WEATHER PREDICTION MODEL: AN OSSE STUDY OF ERICA IOP 4 M.S. Thesis
William J. Schulz, Jr. Mar. 1992 119 p
(AD-A252855) Avail: CASI HC A06/MF A02

An Observing System Simulation Experiment (OSSE) is conducted to investigate the sensitivity of the Naval Research Laboratory (NRL) mesoscale model to atmospheric water and surface wind speed input. The explosively deepening ERICA IOP-4 storm which occurred off the North Carolina coast on 4 January 1989 is used as a case study. Wind speed and water vapor output from the full physics version of the model is shown to reasonably simulate data available from the Special Sensor Microwave/Imager. Assimilating this modeled satellite information into the degraded version of the model shows ERICA IOP-4 to be a dynamically driven storm. Assimilation of simulated wind speed observations yields the best performance for the degraded model in terms of surface pressure deepening. The model exhibits sensitivities to the coverage area of updated information. Two treatments for atmospheric water are tested, showing the sensitivity of the model to these inputs despite their secondary importance in forecasts of storm deepening. GRA

N92-33282# Naval Oceanographic and Atmospheric Research Lab., Monterey, CA.
QUALITY CONTROL OF METEOROLOGICAL OBSERVATIONS Final Report
Nancy L Baker Jan. 1992 26 p
(AD-A253055; NOARL-26) Avail: CASI HC A03/MF A01

Quality control of meteorological observations is an integral part of atmospheric analysis and prediction, since erroneous observations can adversely impact the accuracy of these environmental products. The meteorological observations are subjected to various validation and error checks, as described in this report, prior to their storage in an operational atmospheric data base at the Fleet Numerical Oceanography Center (FNOC). The operational atmospheric data base is used by the Navy's global and regional prediction systems and by the stratospheric analysis. These models provide direct environmental support for fleet operations worldwide. The same quality control procedures were also used for the preliminary error checking of many of the observations gathered during the TCM-90 (Tropical Cyclone Motion) experiment. This initiative, sponsored by the Office of Naval Research, was one component of several joint experiments conducted in the tropical western Pacific Ocean during the summer of 1990. The observations that are processed are from a variety of sources. Each observing platform has its own unique error

characteristics, which must be taken into consideration. These sources include observation of pressure, wind and temperature from ships, fixed and drifting buoys, and land stations. Satellite-based instruments infer atmospheric temperature and moisture profiles, tropospheric wind velocity, and sea-surface wind speeds. Commercial aircraft report air temperature and wind velocity. Perhaps the most important source of information comes from radiosonde and pilot balloon observations of upper atmosphere temperature, moisture, and wind velocity profile.
GRA

N92-33285# Naval Postgraduate School, Monterey, CA.
TESTS OF A CONVECTIVE CLOUD MODEL WITH SOUNDINGS DURING THE TCM-90 FIELD EXPERIMENT M.S. Thesis
Yin Tzy-Chyang Mar. 1992 75 p
(AD-A253069) Avail: CASI HC A04/MF A01

A new proposed scheme for representing cumulus convection in a large-scale numerical model has been tested using the dataset collected during the Tropical Cyclone Motion (TCM-90) field experiment. This new scheme by K. Emanuel incorporated some modifications, which are based on recent observations of convective clouds, and showed that much of the vertical transport of convective clouds was accomplished by subcloud-scale drafts rather than by the clouds themselves. These small-scale drafts were idealized and regarded as the fundamental agents of the convective transport. The input to the idealized model of subcloud-scale updrafts and downdrafts is the one-dimensional arrays of temperature and mixing ratio as a function of pressure, and the output is the tendency of potential temperature and the tendency of mixing ratio as well as the rate of convective precipitation. In this test, 46 dropwindsondes from the TCM-90 dataset with a vertical resolution of 10 mb were chosen as inputs. The convection scheme is integrated in time to investigate the outputs of precipitation rates. The model was forced with constant radiative cooling, convective heating and moistening calculated from the model, and surface fluxes in all cases. We conclude that this new modified convective scheme predicts quite reasonable precipitation rates in the regions beyond 4 degree latitude radius, but not near the center (too small) of Supertyphoon Flo on the 16, 17, and 18 September 1990. GRA

N92-33482*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INERTIAL OSCILLATION OF A VERTICAL ROTATING DRAFT WITH APPLICATION TO A SUPERCELL STORM
Robert C. Costen and Larry V. Stock (Hampton Univ., VA.) Sep. 1992 47 p A video recording supplement L-0592-97; N92-34246 is available from CASI $18 Original contains color illustrations
(RTOP 506-41-41-01)
(NASA-TP-3230; L-16987; NAS 1.60:3230) Avail: CASI HC A03/MF A01; 1 functional color page

An analytic model (vertical rotating draft) which includes the gross features of a supercell storm on an f-plane, undergoes an inertial oscillation that appears to have been overlooked in previous analytic and numerical models. The oscillation is nonlinear and consists of a long quiescent phase and a short intense phase. During the intense phase, the rotating draft has the following features of a supercell: the diameter of the core contracts as it spins up and expands as it spins down; if vertical wind shear is included, the track of the rotating draft turns to the right (an anticyclonic rotating draft turns to the left); this turning point is followed by a predominantly upward flow; and the horizontal pressure gradient is very small (a property of most tornadoless supercells). The rapid spin-up during the intense phase and the high Rossby numbers obtainable establish the ability of the Coriolis force to spin up single cyclonic or anticyclonic supercells by means of this inertial oscillation. This surprising result has implications for numerical supercell simulations, which generally do not rely on the Coriolis force as a source of rotation. The physics and mathematics of the inertial oscillation are given, and the solution is applied to a documented supercell. Author

N92-33590*# Computer Technology Associates, Inc., Rockville, MD.
TROPICAL RAINFALL MEASURING MISSION (TRMM). PHASE B: DATA CAPTURE FACILITY DEFINITION STUDY Final Report
30 Sep. 1990 83 p
(Contract NAS5-30680)
(NASA-CR-189272; NAS 1.26:189272) Avail: CASI HC A05/MF A01

The National Aeronautics and Aerospace Administration (NASA) and the National Space Development Agency of Japan (NASDA) initiated the Tropical Rainfall Measuring Mission (TRMM) to obtain more accurate measurements of tropical rainfall then ever before. The measurements are to improve scientific understanding and knowledge of the mechanisms effecting the intra-annual and interannual variability of the Earth's climate. The TRMM is largely dependent upon the handling and processing of the data by the TRMM Ground System supporting the mission. The objective of the TRMM is to obtain three years of climatological determinations of rainfall in the tropics, culminating in data sets of 30-day average rainfall over 5-degree square areas, and associated estimates of vertical distribution of latent heat release. The scope of this study is limited to the functions performed by TRMM Data Capture Facility (TDCF). These functions include capturing the TRMM spacecraft return link data stream; processing the data in the real-time, quick-look, and routine production modes, as appropriate; and distributing real time, quick-look, and production data products to users. The following topics are addressed: (1) TRMM end-to-end system description; (2) TRMM mission operations concept; (3) baseline requirements; (4) assumptions related to mission requirements; (5) external interface; (6) TDCF architecture and design options; (7) critical issues and tradeoffs; and (8) recommendation for the final TDCF selection process.
I.I.C.

N92-33621# Naval Postgraduate School, Monterey, CA.
EVALUATION OF THE NAVAL RESEARCH LABORATORY LIMITED AREA DYNAMICAL WEATHER PREDICTION MODEL: TOPOGRAPHIC AND COASTAL INFLUENCES ALONG THE WEST COAST OF THE US M.S. Thesis
Frank J. Grandau Mar. 1992 87 p
(AD-A253022) Avail: CASI HC A05/MF A01

This paper describes the evaluation of the NRL Limited Area Dynamical Weather Prediction Model in simulating coastal atmospheric mesoscale phenomena along the west coast of the United States during the period 0000 UTC 2 May - 1200 UTC 3 May 1990. A graphical comparison technique is used. Model output was compared horizontally with large-scale analyses, station data, cross-section analyses, and vertical profiles at specific locations. The model successfully simulated the wind and temperature fields, but failed to accurately replicate moisture and height fields. GRA

N92-33835 Texas A&M Univ., College Station.
SEASONAL VARIATIONS OF TROPICAL OCEANIC RAINFALL CHARACTERISTICS Ph.D. Thesis
Yoo-Shin Ahn 1991 129 p
Avail: Univ. Microfilms Order No. DA9133902

Using infrared cloud top temperatures observed by the Geostationary Operational Environmental Satellite (GOES) - West, an attempt is made to quantify the area-average rainfall by using the GOES precipitation index (GPI). The diurnal and seasonal variations of tropical oceanic rainfall are investigated by using the GPI for the period 19 December 1987 to 31 December 1988 over the central and eastern tropical Pacific Ocean. The coefficient of variation is found as a simple function of the mean. Seasonal variations of the coefficient of variation are small except during Northern Hemispheric summer. The time scales of area-average rainfall over the South Pacific Convergence Zone (SPCZ) are longer than those over the Intertropical Convergence Zone (ITCZ) during Northern Hemispheric winter; however, they have almost the same values as those over the ITCZ region during Northern Hemispheric summer. The coefficient of variation over the Pacific ITCZ region is reasonably close to that in the GARP Atlantic Tropical Experiment

(GATE) region. There are seasonal amplitude variations in the diurnal and semidiurnal cycles. During Northern Hemispheric winter, diurnal and semidiurnal cycle amplitudes are large over the SPCZ region. Power spectrum analysis shows that the SPCZ region has suppressed rainfall at night. Rainfall is enhanced from morning to midafternoon and reaches a maximum between 1400 to 1700 local standard time (LST). During Northern Hemispheric summer, strong diurnal and semidiurnal variations were observed over the ITCZ region. Amplitudes are also large to the north of the ITCZ. The composited diurnal and semidiurnal cycles show rainfall minimum around midnight and a rainfall maximum at 1500 LST. There is also minor enhancement around 0700 LST. These results are consistent with results over the GATE region. Dissert. Abstr.

N92-33849 State Univ. of New York, Binghamton.
A STATISTICAL DESCRIPTION OF STORM CELLS: ANALYSIS OF FILM RECORDS OF THE BINGHAMTON, NEW YORK WSR-57 PPI WEATHER RADAR Ph.D. Thesis
Cynthia Brower Kirby 1991 266 p
Avail: Univ. Microfilms Order No. DA9133373

Considerable effort has been expended recently to mathematically model convective rainstorms. Parameter estimation has lagged behind theoretical work. This investigation utilizes digitized radar imagery to estimate the duration and areal extent of convective cells. The parameters were chosen based on a mathematical model proposed by Rodriguez-Iturbe-Eagelson. Three thunderstorms in the area scanned by the Broome County, New York radar were chosen. The film images of the radar scope taken at 5-minute intervals were digitized. Data were extracted from the digitized image concerning the spatial and temporal characteristics of convective cells. The cells were found to have durations of 20 to 30 minutes, with an exponential distribution. Mean cell area was found to be 15 sq km and best described by a log-normal distribution. Preliminary data descriptions of relative cell precipitation, cell velocity and growth-life-decay cycle were given. Dissert. Abstr.

N92-33850 Texas A&M Univ., College Station.
VARIABILITY AND PREDICTABILITY OF THE SURFACE TEMPERATURE FIELD ON A ZONALLY SYMMETRIC LAND PLANET Ph.D. Thesis
Lai-Yung Leung 1991 135 p
Avail: Univ. Microfilms Order No. DA9133963

An information approach to the study of climate predictability is introduced. This approach uses various information measures based on entropy to define the limits of predictability and to quantify the information given by different climate components and boundary forcings about the prediction of future climate anomalies. Together with a set of basis functions defined through frequency dependent empirical orthogonal functions, this method provides a systematic way of studying the regional predictability of a complex system. The method is applied to study predictability of the atmosphere simulated by the NCAR CCMO on a zonally symmetric land planet. By removing the ocean in the simulation, the time scale of the system has been greatly reduced. Hence, this simulation provides sufficient time samples for realistic study of the properties of the atmospheric component. Atmospheric variability as simulated under the various idealized boundary conditions is studied. This provides noise climatologies useful for climate sensitivity experiments. The space-time statistics of the simulated surface temperature field are fitted satisfactorily by a stochastic climate model with only five parameters. This suggests the usefulness of simple statistical models as guidance for climate sensitivity studies, and sampling considerations for model simulation or data collection. The limit of predictability of the first kind of the surface temperature field is found over two zonal bands: tropics (0 degrees-20 degrees) and mid-latitudes (40 degrees-60 degrees). The predictability as a function of spherical harmonic degree is also evaluated. Results are consistent with past studies of atmospheric predictability using random perturbation experiments. Extension of the above study to climate predictability of the second kind is discussed.
Dissert. Abstr.

N92-33903 Massachusetts Univ., Boston.
A SYNTHESIS OF ATMOSPHERIC TURBULENCE USING A MARKOV CHAIN Ph.D. Thesis
Chiung-yu Syu 1991 213 p
Avail: Univ. Microfilms Order No. DA9132921

The simulation of the atmospheric turbulence has wide applications in science and engineering. There are a variety of modelling techniques for synthesizing a wind speed time series available today. To decide which model to use one has to know the characteristics of the simulation technique. In this dissertation, alternative approaches for synthetically generating a wind speed time series are discussed. These approaches include: (1) the use of independent values from a specific probability distribution; (2) the use of an algorithm based on the statistical behavior of a one step Markov chain; (3) the use of an algorithm based on the behavior of a transition probability matrix that describes the next wind speed value statistically as a function of the current wind speed value and the previous wind speed value; (4) the use of Box-Jenkins model; (5) the use of the Shinozuka algorithm; (6) the use of an embedded Markov chain; and (7) the use of the fractal concept. The ability of each approach to capture the statistical properties of the desired wind speed time series is discussed. Wind speed collected at Windsor, Massachusetts and at Altamont, California are used as target wind speed values. Each model will be used to generate a synthetic wind speed for each site to compare with the real wind speed. The performance of each model will be decided on by the statistical similarity of the synthetic wind speed to the real wind speed. The criteria of the statistical similarity include the mean and the variance of the wind speed values, the probability distribution of the wind speed values, the power spectrum of the wind speed values and the autocorrelation function of the wind speed values. One of the applications of the wind speed simulation is to fill in a missing segment of a wind speed time series. In this context the missing segment of the wind speed at Cuttyhunk island is simulated and filled in for the study of a wind/diesel energy conversion system.
Dissert. Abstr.

N92-33959 Oxford Univ. (England).
AN INTERMEDIATE MODEL OF THE TROPICAL OCEANS AND ATMOSPHERE Ph.D. Thesis
Garry R. Budin 1990 225 p
Avail: Univ. Microfilms Order No. BRD-93058

Recent research has shown that interannual variability in the tropical Pacific Ocean and overlying atmosphere is due to ocean-atmosphere feedbacks. We examine these interactions with a model of intermediate complexity. The atmospheric model is a reduced gravity model which includes moist processes. When forced with observed sea surface temperatures it produces a reasonable simulation of the tropical circulation. The ocean model used is also based on the shallow-water equations, extended to include thermodynamic processes. It is verified by simulating the 1982/83 El Nino event. When forced with observed winds the model simulates the eastward movement of warm water. Coupling the models in simple basins gives interannual disturbances which develop in the western Pacific and propagated eastward. This behavior shows a resemblance to the observed El Nino cycle, but is more regular. The disturbances redevelop via land-sea heating contrast and ocean-atmosphere feedback. The inclusion of moisture in the atmosphere does not significantly alter the model behavior. A coupled model with more realistic tropical geometry shows a strong dependence on land heating and points to the importance of land and moisture processes over the 'maritime continent' area in affecting interannual behavior. Annual cycle experiments link the interannual development to the annual cycle. Inclusion of intraseasonal variability does not alter the model behavior; the dominant circulation is associated with the interannual disturbance, with only a local response to intraseasonal variability.
Dissert. Abstr.

N92-33969 Nottingham Univ. (England).
REMOTE SENSING OF SEASONAL VARIATIONS IN ALBEDO

OVER SOUTHERN BRITAIN Ph.D. Thesis
Allan R. James 1990 437 p
Avail: Univ. Microfilms Order No. BRD-93841

This research attempted to investigate the applicability of satellite derived data for measuring surface albedo, to investigate the relationship of surface albedo to land cover and land class, and to measure seasonal and episodic variations in surface albedo. Results from satellite mounted narrow-band radiometers, (AVHRR), were contrasted with comparable results obtained from broad-band aircraft mounted pyranometers. Results were found to be comparable provided recognizable atmospheric and geometric limits were not exceeded. Seasonal variations in the surface albedo of specific vegetation classes were monitored and the results used to estimate the seasonal variation of surface albedo over the lowlands of England and Wales. It was found that agricultural areas which have exposed a large area of bare soil for part of the growing season, exhibited a greater variation of surface albedo, (of approx. 0.02), throughout that growing season than did grassland areas. At the country scale this translated into a greater change over the growing season in the surface albedo of the south and east of England than in the predominantly grassland areas of West England and Wales. Throughout the growing season there was a characteristic pattern of vegetated areas consisting of mixed grassland and arable with a decrease in albedo in late spring leading to a rise and peak in mid-summer, a rapid fall in early autumn to a seasonal minimum and ending in a steady increase in late autumn to the seasonal average. This pattern resulted from a combination of seasonal variations in agricultural practices and changes in vegetation morphology. The results showed that within definable limits, satellite derived values could be used to calculate the surface albedo of vegetated surfaces at the scale of 100 sq. km or more. The variation in these results was largely a result of the inability of the atmospheric correction program to accurately model the true atmosphere, and to the difficulty in obtaining a broad-band surface albedo value from narrow-band radiometer data. The assumption of a Lambertian surface was also expected to reduce the final accuracy of the results. Dissert. Abstr.

N92-34035 Utah Univ., Salt Lake City.
INFERENCE OF CIRRUS CLOUD PROPERTIES FROM SATELLITE-OBSERVED VISIBLE AND INFRARED RADIANCES Ph.D. Thesis
Patrick Minnis 1991 179 p
Avail: Univ. Microfilms Order No. DA9133655

Current techniques for deriving cirrus optical depth and altitude from visible (0.65 micron) and infrared (11.5 micron) satellite data use radiative transfer calculations based on spherical water droplet, scattering phase functions. This study examines the impact of using phase functions for spherical droplets and hexagonal ice crystals to analyze radiances from cirrus. Adding-doubling radiative transfer calculations are used to compute radiances for different cloud thicknesses and heights over various backgrounds. These radiances are used to develop parameterizations of top-of-the-atmosphere visible reflectance and infrared emittance utilizing tables of reflectance as a function of cloud optical depth, viewing and illumination angles, and microphysics. This parameterization reproduces the computed reflectances with a precision of +/- 6 percent for four microphysical models: 10 micron water droplet (WD), small symmetric crystal (C20), cirrostratus (CS), and cirrus uncinus. This precision is twice that of previous parameterizations. The infrared emittances are reproduced with a precision of +/- 2 percent. Infrared scattering reduces emittance by an average of 5 percent. Optical depths and cloud temperatures can be derived with an accuracy of approximately 25 percent and approximately 6 K for typical cirrus conditions. Retrievals of colder clouds over brighter surfaces are not as accurate. A methodology is developed to apply the parameterization to satellite analyses. Cloud heights and optical depths were derived from satellite measurements taken during the First ISCCP (International Satellite Cloud Climatology Project) Regional Experiment (FIRE) when cirrus was present. Comparisons with lidar-derived cloud heights reveal that the WD model underestimates cirrus heights by approximately 1.5 km on average. The bias results from overestimates of the cloud optical depths which are as much as 1.7 times greater than the C20 values. The C20 and CS models produced mean cloud heights within +/- 0.3 km of the lidar results and had instantaneous uncertainties of +/- 1.3 km. Reflectance patterns computed with the ice-crystal models are consistent with multi-angle observations. The WD model reflectances cannot be reconciled with the dual-satellite bidirectional measurements. It is concluded that interpretation of cirrus reflectance with water droplet models leads to biased results. The biases can be minimized with the use of the C20 or CS model. Dissert. Abstr.

N92-34044 Utah Univ., Salt Lake City.
DEVELOPMENT AND VERIFICATION OF A THREE-DIMENSIONAL LARGE-SCALE CLOUD MODEL Ph.D. Thesis
Jin-Luen Lee 1991 165 p
Avail: Univ. Microfilms Order No. DA9129287

A time-dependent, three-dimensional, large-scale cloud model was developed for the prediction of cloud cover, cloud liquid/ice water content (LWC/IWC), precipitation, specific humidity, and temperature. Partial cloudiness is allowed to form when large-scale relative humidity is less than 100 percent. Both liquid and ice phases are included in the model. The liquid phase processes consist of evaporation, condensation, autoconversion, and precipitation. The ice phase processes include heterogeneous nucleation to generate ice crystals, depositional growth to simulate Bergeron-Findeison's processes, sublimation to deplete ice crystals, and gravitational settling of ice crystals. The radiative transfer parameterization program is based on a broadband method and involves the transfer of infrared and solar radiation in clear and cloudy regions. The broadband infrared emissivity, reflectivity, and transmissivity for cirrus clouds, as well as the broadband solar absorption, reflection, and transmission values for various cloud types are computed based on the cloud LWC and IWC interactively generated by the cloud model. Clouds, through their radiative properties, may produce changes in radiative heating, which in turn feeds back to the clouds via the thermodynamic equation and modifies the cloud fields. Therefore, cloud-radiation interaction through the medium of cloud cover, and cloud LWC and IWC is accomplished with the aid of the cloud model. Large amounts of satellite data, including cloud cover climatology derived from the U.S. Air Force three-dimensional nephanalysis (3DNEPH) and earth radiation budget (ERB), were processed into formats appropriate for verification. The 96-hour model simulations of cloud cover, outgoing longwave radiation (OLR) and net solar flux at the top of the atmosphere (TOA), and cloud LWC were verified against data analyzed from 3DNEPH, ERB, and the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) satellite observations, respectively. The predicted cloud IWC is compared to in situ observations as well as to results from other studies. Numerical experiments are carried out with and without radiation and ice phase processes in the cloud formation scheme.
Dissert. Abstr.

N92-34046 Pennsylvania State Univ., University Park.
VARIABILITY OF 500-mb GEOPOTENTIAL HEIGHTS IN A GENERAL CIRCULATION MODEL AND THE PROJECTION OF REGIONAL GREENHOUSE EFFECT CLIMATE CHANGE Ph.D. Thesis
Michael Anthony Palecki 1991 256 p
Avail: Univ. Microfilms Order No. DA9127396

Many researchers have utilized general circulation models (GCM's) in establishing climate change scenarios for specific regions or locations, despite the mismatch of spatial scales involved. A major underlying assumption involved in utilizing model output in this manner is that the GCM contains mid-tropospheric dynamics that are internally consistent with those of the real climate system. The main purpose of this study is to examine the forms and processes of mid-tropospheric variability in the Goddard Institute for Space Studies (GISS) GCM, with the hope of shedding light on this model-analog strategy. The response of mean 500 mb and surface air temperature fields in the GISS GCM to a

doubling of CO2 indicates a substantial relationship between the two. Unfortunately, the GISS GCM demonstrates systematic flaws in its simulation of mid-tropospheric dynamics. These are revealed in an examination of high-frequency and low-frequency 500-mb teleconnections in the model. The shapes and amplitudes of known teleconnection patterns are not simulated well. This is likely due to the weak stationary wave structure found in the control run of the model. More importantly, several model teleconnections appear to coincide geographically with the patterns of mean climate change. This may indicate a direct relationship between the modeled mid-tropospheric dynamics and the spatial patterns of mean climate change. This finding has two important implications. First, it is necessary to further study the influence of GCM mid-tropospheric dynamics on the spatial distribution of climate changes being modeled. Second, and more fundamentally, spatially specific climate system feedbacks may be substantially affected by variations in teleconnection strength and frequency, potentially impacting the global climate far beyond the regional scale.
Dissert. Abstr.

N92-34056 Pennsylvania State Univ., University Park.
A NEW PATTERN RECOGNITION TECHNIQUE, WITH AN EXAMPLE OF LOCATING FRONTS IN MODEL OUTPUT AND AN EXAMPLE OF IDENTIFYING INCORRECT VELOCITIES IN DOPPLER WIND PROFILER DATA Ph.D. Thesis
Steven S. Fine 1991 105 p
Avail: Univ. Microfilms Order No. DA9127324

A statistical pattern recognition technique called Independent Rules with Empirical Weights (IREW) is described. IREW has several strengths, such as fast execution, small storage requirements, and incremental learning, that can make the technique useful for many meteorological pattern recognition problems. A weakness of IREW is that it may not recognize complex patterns as well as more sophisticated pattern recognition techniques. IREW analyzes data by using a derivative of Bayes' rule to multiplicatively combine the influence of predictors. The weight assigned to each predictor is determined empirically from a training data set containing the data and verifications for multiple cases. IREW uses several methods to select useful subsets of a large set of predictors. The objective identification of surface fronts in Nested Grid Model forecasts is described to illustrate how IREW can be applied to a typical pattern recognition problem. The work consisted of identifying factors related to fronts and using some of those factors to make analyses. Given 27,000 predictors, IREW selected many that meteorologists associate with fronts. IREW's analyses were compared to subjective analyses for seven test cases. In this limited test, IREW performed similarly to meteorologists in terms of the number of grid points correctly classified as frontal or non-frontal. The identification of incorrect velocities in Doppler wind profiler data is also described. This work further illustrates IREW's usefulness and also illustrates the feasibility of correcting profiles in real time. IREW was able to correctly classify many of the velocities that a meteorologist considered to be incorrect, but for some cases IREW also classified as incorrect many velocities that the meteorologist considered to be correct. The results of a composite technique, which included IREW, for identifying and correcting incorrect velocities are also presented. The composite technique required two-tenths of a second of computation time on a microcomputer to analyze one profile, and the technique noticeably reduced the magnitude of errors in strongly contaminated profiles without greatly increasing the errors in most of the reliable profiles. Dissert. Abstr.

N92-34091*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
RAMAN LIDAR MEASUREMENTS OF WATER VAPOR AND AEROSOL/CLOUDS DURING THE FIRE/SPECTRE FIELD CAMPAIGN
S. H. Melfi, D. Whiteman, R. Ferrare (Universities Space Research Association, Columbia, MD.), and K. Evans (Hughes STX, Inc., Lanham, MD.) 1992 7 p Presented at the 16th International Laser Radar Conference, Cambridge, MA, 20-24 Jul. 1992
(Contract DE-AC04-76DR-00789)
(NASA-TM-107997; NAS 1.15:107997; DE92-016821; SAND-92-8545C; CONF-9207107-1) Avail: CASI HC A02/MF A01

The FIRE/SPECTRE field campaign was conducted during November-December 1991 in Coffeyville, Kansas. The main objective of FIRE (First International Satellite Cloud Climatology Project Regional Experiment) was to study the development and radiative characteristics of cirrus clouds. The SPECTRE (Spectral Radiation Experiment) project was designed to acquire the necessary atmospheric observations to compare radiative measurements with radiative transfer theory, with special emphasis on understanding the water vapor spectral continuum. A complete understanding of water vapor, its distribution with height, and its temporal variation was important for both experiments. A ground-based Raman lidar was deployed at Coffeyville, Kansas from November 12 until December 7, 1991. During the campaign, the lidar operated during 14 observation periods. The periods ranged in length from 3.5 hours to 12 hours for a total operating time of approximately 119 hours. During each of the operational periods, the lidar obtained vertical profiles of water vapor mixing ratio and aerosol scattering ratio once every minute with vertical resolution of 75 meters from near the earth's surface to an altitude of 9-10 km for water vapor and higher for aerosols. Several balloon-sondes were launched during each operational period providing an independent measurement of humidity with altitude. For each operational period, the 1-minute profiles of water vapor mixing ratio and aerosol scattering ratio are composited to give a color-coded time-height display of water vapor and aerosol scattering, respectively. DOE

N92-34100# Lawrence Livermore National Lab., CA.
ATMOSPHERIC CHEMISTRY AND CLIMATE PREDICTABILITY: TOWARDS AN ADVANCED CLIMATE MODEL
D. J. Wuebbles, J. E. Penner, and D. A. Rotman Apr. 1992 4 p Presented at the Computer Hardward Advanced Mathematics and Model Physics (CHAMMP) Science Meeting, Las Vegas, NV, 17 Mar. 1992
(Contract W-7405-eng-48)
(DE92-017437; UCRL-JC-110812; CONF-9203118-2) Avail: CASI HC A01/MF A01

The goal of this project is to emphasize the role of atmospheric chemistry and tracer transport in determining the predictability of climate change and to develop the chemical-transport modeling capability needed for advanced climate modeling through accurate and efficient calculations of global climate phenomena affected by atmospheric chemistry, radiation, and transport processes. The interactions between these processes are of major importance to the large questions of global climate change, and in general, to global climates. This study has four main objectives: (1) to show and investigate the strong interaction between chemistry and global climate and global climate change, with the purpose of determining how these interactions affect climate predictability and the accuracy with which climate projections can be made; (2) to study and develop new model physics and numerical algorithms for atmospheric chemical, radiative, microphysical, and transport processes which are needed for a more accurate prediction of global climate and climate change; (3) to develop a next generation three dimensional chemistry-transport model that can fully interface (or be run stand alone when appropriate) with a GCM within the advanced climate modeling framework to accurately calculate these interactions on a regional to global scale; and (4) to design and implement this new chemistry-transport model on a massively parallel machine for high resolution large-scale application to global change questions. DOE

N92-34159# Scripps Institution of Oceanography, La Jolla, CA. Marine Physical Lab.
ANALYSIS AND INTERPRETATION OF SIMULTANEOUS MULTI-STATION WHOLE SKY IMAGERY Final Report, 30 Dec. 1987 - 30 Sep. 1991
Richard W. Johnson, Janet E. Shields, and Thomas L. Koehler 30 Sep. 1991 84 p

(Contract F19628-88-K-0005)
(AD-A253685; SIO-REF-91-33; MPL-U-98/91; PL-TR-91-2214; AD-E201092) Avail: CASI HC A05/MF A01

This report summarizes the development and use of a digital data base containing approximately 900 Gigabytes of raw image data and about 675 Gigabytes of processed data. These images represent 4614 data days geographically distributed among seven CONUS sites; they reside on approximately 900 eight-millimeter tape cassettes. The imagery was acquired by an automatic, computer controlled, electronic camera system. In addition to the data base summary, this report discusses selected aspects of the overall data processing procedures, the physical nature of the tape archive, the development of the automatic cloud decision algorithm, and several resultant applications of the data to comparative studies and model development. The imagery yields statistical and specific case study representations which compare well with the classical observational formats reported by weather stations personnel. The numerical data have served as preliminary inputs and conceptual baselines leading to the development of new stochastic modeling techniques. GRA

N92-34175*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE ATLANTIS (STS-43) LAUNCH
G. L. Jasper and G. W. Batts (New Technology, Inc., Huntsville, AL.) Sep. 1992 47 p
(NASA-TM-103603; NAS 1.15:103603) Avail: CASI HC A03/MF A01

A summary of selected atmospheric conditions observed near Space Shuttle Atlantis (STS-43) launch time on August 2, 1991, at Kennedy Space Center, Florida is presented. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere-measured vertical wind profiles is given. The final atmospheric profile, which consists of wind and thermodynamic parameters versus altitude, for STS-43 vehicle ascent was constructed. The STS-43 ascent atmospheric data profile was constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consisted data set for use in postflight performance assessments and represents the best estimate of the launch environment to the 400,000-ft altitude that was traversed by the STS-43 vehicle. Author

N92-34223*# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
RESEARCH RELATIVE TO WEATHER RADAR MEASUREMENT TECHNIQUES Final Technical Report, 15 Nov. 1990 - 14 Aug. 1992
Paul L. Smith Aug. 1992 15 p
(Grant NAG5-1477)
(NASA-CR-190637; NAS 1.26:190637; SDSMT/IAS/R-92/08) Avail: CASI HC A03/MF A01

Research relative to weather radar measurement techniques, which involves some investigations related to measurement techniques applicable to meteorological radar systems in Thailand, is reported. A major part of the activity was devoted to instruction and discussion with Thai radar engineers, technicians, and meteorologists concerning the basic principles of radar meteorology and applications to specific problems, including measurement of rainfall and detection of wind shear/microburst hazards. Weather radar calibration techniques were also considered during this project. Most of the activity took place during two visits to Thailand, in December 1990 and February 1992. Author

N92-34227*# Wisconsin Univ., Madison. Space Science and Engineering Center.
AN INVESTIGATION OF THE ROLE OF CURRENT AND FUTURE REMOTE SENSING DATA SYSTEMS IN NUMERICAL METEOROLOGY Final Progress Report
George R. Diak and William L. Smith Sep. 1992 13 p
(Contract NCC8-12)
(NASA-CR-190835; NAS 1.26:190835) Avail: CASI HC A03/MF A01

A flexible system for performing observing system simulation experiments which made contributions to meteorology across all elements of the observing system simulation experiment (OSSE) components was developed. Future work will seek better understanding of the links between satellite-measured radiation and radiative transfer in the clear, cloudy and precipitating atmosphere and investigate how that understanding might be applied to improve the depiction of the initial state and the treatment of physical processes in forecast models of the atmosphere. Author

N92-34246* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INERTIAL OSCILLATION OF A VERTICAL ROTATING DRAFT WITH APPLICATION TO A SUPERCELL STORM: VIDEO SUPPLEMENT TO NASA TECHNICAL PAPER 3230 (Video Recording)
Robert C. Costen and Larry V. Stock (Hampton Univ., VA.) 15 Sep. 1992 This supplements NASA-TP-3230; N92-33482 Video Recording: 8 min., color, sound, VHS
(RTOP 506-41-41-01)
(NASA-TP-3230-Video-Suppl; L-0592-97; NAS 1.60:3230-Video-Suppl) Avail: Issuing Activity (Center for AeroSpace Information) Video Recording $18

In this video (8 min., color, sound, VHS), animation depicts the inertial oscillation of a new mathematical model ('vertical rotating draft') for spinning up a single supercell storm. The oscillation consists of a long quiescent phase when the draft is large in diameter and rotates anticyclonically and a short intense phase when the draft is small and cyclonic. During the intense phase, the rotating draft resembles a supercell. The physical basis for the oscillation is depicted by tracking air parcels in the draft as they move along inertial circles (projected on a horizontal plane), where the horizontal pressure gradient is zero and the Coriolis force balances the centrifugal force. A side view of the oscillation shows that contraction and expansion are linked, respectively, to buoyantly driven compressible downdraft and updraft. An aerial view tracks the draft as it moves above the surface of the Earth and turns to the right during the intense phase. Radar echoes from a supercell storm are superimposed for comparison. The data appear to support only the intense phase. A critical experiment would measure the predominantly downward flow that theoretically occurs before the right turn in a supercell track and causes contraction and spin-up. Author

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N92-33278# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
OBJECTIVE DAILY MAPS OF THERMOCLINE DEPTH FOR THE SYNOP EASTERN ARRAY Final Technical Report
Z. R. Hallock May 1992 63 p
(AD-A252868; NOARL-TN-259) Avail: CASI HC A04/MF A01

A major component of the field activities for the northwest Atlantic Regional Energetics Experiment (REX) is focused on the acquisition and analysis of data from inverted echo sounders (IES's). This technical note describes an analysis of data records from nine IES's deployed in an array near 40 min N, 55 min W. IES acoustic travel-time data were converted to thermocline depths, which were in turn objectively interpolated and contoured, resulting in daily maps. These maps provide a useful tool for studying the evolution of mesoscale features in the area of the experiment. GRA

N92-33417# Naval Oceanographic Office, Bay Saint Louis, MS.
CONVERSION OF CONTOURED POLAR STEREOGRAPHIC PROJECTED DATA INTO THE ENVIRONMENTAL ACOUSTIC INTERACTIVE DATA SYSTEM (EAIDS)
Ernest A. Wiley and James J. Koshmann May 1992 15 p
(AD-A252847; NOO-TN-01-92) Avail: CASI HC A03/MF A01

In support of the Oceanographic and Atmospheric Master Library, the Naval Oceanographic Office (NAVOCEANO) was tasked with updating the Arctic Sediment Thickness Data Base. The data for this update were received as a Polar Stereographic Chart that was prepared by H.R. Jackson. This technical note describes the conversion of these polar stereographic data into a format acceptable for input into the Environmental Acoustic Interactive Data System (EAIDS). GRA

N92-33735# Science Applications International Corp., McLean, VA.
VERIFICATION AND CALIBRATION OF AN EDDY-RESOLVING MODEL OF THE GULF OF MEXICO
James K. Lewis, Lakshmi Kantha, Artemio Gallegos, and Ranjit Passi May 1991 16 p
(NR Proj. R31-0300)
(AD-A252398; SAIC-91/1134; NOARL-TR-1) Avail: CASI HC A02/MF A01

Techniques for verifying and calibrating an eddy-resolving ocean circulation model were applied to a model of the Gulf of Mexico (GOM). Various kinematic parameters were calculated using drifter data from GOM Loop Current eddies, and from indices of rotational period versus eddy age and swirl velocity versus distance the eddy center were determined. The observed kinematics were then compared to the same parameters calculated from a model eddy. Although the model can simulate the movement and translation velocities of actual Gulf of Mexico eddies, it does not reproduce the interior flow characteristics of such eddies. In particular, the period of rotation about the center of a model eddy is considerably different from what is observed. The first attempt at calibrating the model was the development of more realistic inflow conditions in the Yucatan Straits. A variety of data sets were synthesized to produce the two-dimensional distributions of temperature, salinity, density, and northward velocity as well as the east-west variations of surface height. GRA

N92-33737*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SeaWiFS CALIBRATION AND VALIDATION PLAN, VOLUME 3
Stanford B. Hooker, ed., Elaine R. Firestone, ed. (General Sciences Corp., Laurel, MD.), Charles R. McClain, Wayne E. Esaias, William Barnes, Bruce Guenther, Daniel Endres, B. Greg Mitchell (National Aeronautics and Space Administration, Washington, DC.), and Robert Barnes (Chemal, Inc., Wallops Island, VA.) Sep. 1992 45 p
(NASA-TM-104566-Vol-3; NAS 1.15:104566-Vol-3; Rept-92B00117) Avail: CASI HC A03/MF A01

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) will be the first ocean-color satellite since the Nimbus-7 Coastal Zone Color Scanner (CZCS), which ceased operation in 1986. Unlike the CZCS, which was designed as a proof-of-concept experiment, SeaWiFS will provide routine global coverage every 2 days and is designed to provide estimates of photosynthetic concentrations of sufficient accuracy for use in quantitative studies of the ocean's primary productivity and biogeochemistry. A review of the CZCS mission is included that describes that data set's limitations and provides justification for a comprehensive SeaWiFS calibration and validation program. To accomplish the SeaWiFS scientific objectives, the sensor's calibration must be constantly monitored, and robust atmospheric corrections and bio-optical algorithms must be developed. The plan incorporates a multi-faceted approach to sensor calibration using a combination of vicarious (based on in situ observations) and onboard calibration techniques. Because of budget constraints and the limited availability of ship resources, the development of the operational algorithms (atmospheric and bio-optical) will rely heavily on collaborations with the Earth Observing System (EOS), the Moderate Resolution Imaging Spectrometer (MODIS) oceans team, and projects sponsored by other agencies, e.g., the U.S. Navy and the National Science Foundation (NSF). Other elements of the plan include the routine quality control of input ancillary data (e.g., surface wind, surface pressure, ozone concentration, etc.) used in the processing and verification of the level-0 (raw) data to level-1 (calibrated radiances), level-2 (derived products), and level-3 (gridded and averaged derived data) products. Author

N92-33800# National Marine Fisheries Service, Galveston, TX.
SEASONAL CLIMATOLOGIES AND VARIABILITY OF EASTERN TROPICAL PACIFIC SURFACE WATERS
Paul C. Fiedler (National Oceanic and Atmospheric Administration, La Jolla, CA.) Apr. 1992 71 p
(PB92-193408; NOAA-TR-NMFS-109) Avail: CASI HC A04/MF A01

Interannual variability caused by the El Nino-Southern Oscillation in the eastern tropical Pacific Ocean (ETP) is analogous to seasonal variability of comparable magnitude. Climatological spatial patterns and seasonal variability of physical variables that may affect the ETP ecosystem are presented and discussed. Surface temperatures, surface salinity, mixed layer depth, thermocline depth, thermocline strength, and surface dynamic height were derived from bathythermograph, hydrocast, and CTD data. Surface current velocity, divergence, and upwelling velocity were derived from ship drift report. Surface wind velocity, wind stress, wind divergence, wind stress curl, and Ekman pumping velocity were derived from gridded pseudostress data obtained from Florida State University. Seasonal maps of these variables, and their deviations from the annual mean, show different patterns of variation in Equatorial and Tropical Surface Water. Seasonal shifts in the trade winds, which affect the strength of equatorial upwelling and the North Equatorial Countercurrent, cause seasonal variations in most variables. Author

N92-34089 Colorado Univ., Boulder.
AN ALTIMETRIC STUDY ON THE BRANCHING OF THE GULF STREAM SYSTEM INTO THE NORTH ATLANTIC AND AZORES CURRENTS Ph.D. Thesis
Patrick Charles Allen 1991 110 p
Avail: Univ. Microfilms Order No. DA9132540

In this work, two investigations were performed. The first entailed a comparison of standard orbit error removal techniques with a newly proposed minimum variance technique. In this comparison, both simulated and real data sets were used. For these data sets, the new method was shown to minimize the orbit error while maximizing the mesoscale signals that we sought to recover. An important feature of this new method is the ability to work with data arcs of various lengths without necessitating any truncation. The second investigation concerned the bifurcation of the Gulf Stream into the North Atlantic Current and the Azores Current. It was found that the Gulf Stream separates into two branches southeast of the Newfoundland Banks in the vicinity of 40 degrees N 315 degrees E. The northern branch forms the North Atlantic Current while the southern branch feeds the Azores Current. The southern branch of the Gulf Stream was seen to cross the Mid Atlantic Ridge (MAR) in the vicinity of the Oceanographic Fracture Zone (OFZ). After crossing the OFZ, this branch becomes known as the Azores Current. The Azores Current was found to extend into the Canary Basin as far east as 335 degrees E. The North Atlantic Current (NAC), which forms the northern branch of the Gulf Stream, was found to flow northward around the Banks past the Flemish Cap. To the northwest of the Flemish Cap, the NAC forms a loop, then flows eastward to cross the MAR near 50 degrees N. Variability associated with a broad easterly drift was seen to extend as far east as 345 degrees and as far north as 52 degrees. It was also noted that variability features seen at 55 degrees N 335 degrees E could possibly mark the location of the NAC once it turns northward after crossing the MAR. Dissert. Abstr.

N92-34118# Washington Univ., Seattle. School of Oceanography.
EFFECTS OF BOTTOM TOPOGRAPHY ON OCEAN GENERAL CIRCULATION Final Report
Walter A. Harrison Jun. 1992 19 p
(Contract N00014-90-J-1102)
(AD-A253121) Avail: CASI HC A03/MF A01

The long-range objective of the PI is to understand the motion of deep waters throughout the abyssal basins of the world ocean, both along the boundaries and over the abyssal plains. The zeroth-order theory of the spread of the deep water was presented in a classical paper by Stommel and Arons (1960), which assumed uniform upwelling of the bottom water above a flat-bottomed ocean. However, the real ocean floor displays rich variations in topography from isolated seamounts to the global system of mid-ocean ridges. These topographic features guide and sometimes prevent the movement of deep waters, thereby controlling the general circulation. Also, superimposed on the large-scale, thermohaline upwelling circulation are the local wind-driven circulation which can penetrate to the ocean bottom in such regions as the recirculation gyres of the mid-latitudes and the Antarctic Circumpolar Current region. The aim of this project was to understand the effect of bottom topography on the abyssal circulation of the world ocean from a theoretical angle. Analytical, simple numerical and laboratory models were employed for this purpose. GRA

51 LIFE SCIENCES (GENERAL)

N92-33301# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
CHARACTERIZATION OF GLUCOSE MICROSENSORS SMALL ENOUGH FOR INTRACELLULAR MEASUREMENTS
Takayuki Abe, Yau Y. Lau, and Andrew G. Ewing 22 Jan. 1992 22 p
(AD-A252954; TR-013) Avail: CASI HC A03/MF A01

Ultrasmall glucose sensors were constructed by using platinum deposited carbon ring microelectrodes with glucose oxidase. Response times as low as 270 ms were obtained with these sensors. Moreover, there is a linear relationship between sensor tip diameter and response times. The use of these sensors was demonstrated in the detection of glucose in a single cell cytoplasm of the large dopamine cell of the pond snail, Planorbis corneus. Current responses obtained at these sensors implanted into a cell increase following injection of 2 pL glucose solution (3 M) into the cell. Results obtained from these experiments show that these sensors are suitable for glucose monitoring in ultrasmall environments. In addition, characterization of these sensors was investigated under different O2 concentrations. At atmospheric oxygen concentrations, glucose levels in the submillimolar range can be measured without oxygen interference; however, oxygen interference can be substantial at low oxygen concentrations. GRA

N92-33563# Interface Foundation of North America, Inc., Fairfax Station, VA.
COMPUTING SCIENCE AND STATISTICS: PROCEEDINGS OF THE SYMPOSIUM ON THE TWENTY-THIRD INTERFACE CRITICAL APPLICATIONS OF SCIENTIFIC COMPUTING: BIOLOGY, ENGINEERING, MEDICINE AND SPEECH Final Report, 15 Mar. 1991 - 14 Mar. 1992
Jon R. Kettenring and Elaine M. Keramidas 1992 665 p Proceedings held in Seattle, WA, 21-24 Apr. 1991
(Contract DAAL03-91-G-0085)
(AD-A252938; ARO-28534.1-MA-CF) Avail: CASI HC A99/MF A06

The extremely successful workshop on Computational Molecular Biology featured world-renowned speakers. The workshop served as a focused example of the very real interface between biology, statistics, and computing science. Much of the success of a conference can be measured in terms of the number of attendees and the number of contributed talks, which, for this Symposium, were approximately 400 and 116, respectively. These Proceedings include 78 percent of the contributed papers and 65 percent of the invited papers that were given in Seattle - a more than adequate representation of the work presented at the Symposium. GRA

N92-33651# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
FLUORESCENCE AND UV SPECTROSCOPIC EXAMINATIONS WITH PS-TIME RESOLUTION FOR SYSTEM 2 OF PHOTOSYNTHESIS Ph.D. Thesis [FLUORENSZENZ- UND UV-SPEKTROSKOPISCHE UNTERSUCHUNGEN MIT PS-ZEITAUFLOESUNG AM SYSTEM 2 DER PHOTOSYNTHESE]
Johannes Bernarding 1991 172 p In GERMAN
(ETN-92-92129) Avail: CASI HC A08/MF A02

Determinations of ultraviolet absorption changes and fluorescence decay kinetics in a PS (Photon System) field were carried out for charge and energy transfer in PS2 enriched membrane fragments. A test impulse spectrometer was developed for measuring time resolved absorption changes in an ultraviolet field. The scanning pulse was produced by frequency doubling of a small part of the excitation beam. A model describing absorption changes after excitation, using laser pulses of various pulse energies, was developed. Strong continuous light from the visible spectral field led to various effects on both components of the fluorescence decay curve under aerobic and strongly reducing conditions. ESA

N92-33698*# Alabama A & M Univ., Normal. Dept. of Plant and Soil Science.
A PROPOSAL TO DEMONSTRATE PRODUCTION OF SALAD CROPS IN THE SPACE STATION MOCKUP FACILITY WITH PARTICULAR ATTENTION TO SPACE, ENERGY, AND LABOR CONSTRAINTS Annual Progress Report, 1 Jul. 1991 - 30 Jun. 1992
Carolyn Brooks 30 Jun. 1992 44 p
(Contract NCC2-607)
(NASA-CR-190575; NAS 1.26:190575) Avail: CASI HC A03/MF A01

This research has continued along two lines, one at Marshall Space Flight Center with Salad Machine Rack development and the design and construction of a mockup for placement in the Huntsville Space Station Freedom mockup. The second avenue of research has addressed issues of relevance to the operation of the Salad Machine and Bioregenerative systems. These issues include plant species compatibility when grown on shared hydroponic systems and microbial populations of mixed species hydroponic systems. Significant progress is reported. Author

N92-33747*# National Academy of Sciences - National Research Council, Washington, DC. Commission on Physical Sciences, Mathematics, and Applications.
BIOLOGICAL CONTAMINATION OF MARS: ISSUES AND RECOMMENDATIONS
1992 123 p
(Contract NASw-4627)
(NASA-CR-190819; NAS 1.26:190819) Avail: CASI HC A06/MF A02

The ad hoc Task Group on Planetary Protection formed by the Space Studies Board (SSB) of the National Research Council focused on making recommendations concerning the protection of Mars from forward contamination (i.e., Earth to Mars) during upcoming missions by both the United States and the former Soviet Union. In so doing, it distinguished between missions whose goals include reconnaissance and measurement and those that specifically include experiments to detect life. The task group also discussed what additional knowledge will be needed in order to assure that future recommendations regarding contamination of Earth from Mars might be made with a higher degree of certainty than is now possible. Following a short introduction to the rationale underlying planetary exploration (Chapter 1) is a brief summary of approved and contemplated missions to Mars (Chapter 2). Chapter

3 briefly reviews the state of knowledge in several areas pertinent to the problem of planetary protection, in the limits of life on Earth and the abilities of known terrestrial organisms to withstand extreme environment conditions, as well as new approaches to detecting life forms. Chapter 5 includes a review and comments (made in light of current knowledge)- on the recommendations made in 'Recommendations on Quarantine Policy for Mars, Jupiter, Saturn, Uranus, Neptune, and Titan'. Updates to the recommendations made in 1978 are also given in Chapter 5. Chapter 6 gives additional recommendations concerning collection of essential data, spacecraft sterilization and bioburden assessment, and future research, as well as legal and social issues and NASA's overall planetary protection program. I.I.C.

N92-33978# California Univ., Los Angeles.
CARBON DIOXIDE AND THE STOMATAL CONTROL OF WATER BALANCE AND PHOTOSYNTHESIS IN HIGHER PLANTS
1992 7 p
(Contract DE-FG03-90ER-20011)
(DE92-016530; DOE/ER-20011/T1) Avail: CASI HC A02/MF A01

Research continued into the investigation of the effects of carbon dioxide on stomatal control of water balance and photosynthesis in higher plants. Topics discussed this period include a method of isolating a sufficient number of guard cell chloroplasts for biochemical studies by mechanical isolation of epidermal peels; the measurement of stomatal apertures with a digital image analysis system; development of a high performance liquid chromatography method for quantification of metabolites in guard cells; and genetic control of stomatal movements in Pima cotton. DOE

N92-33995# European Space Agency, Paris (France).
EXOGENOUS AND ENDOGENOUS CONTROL OF ACTIVITY BEHAVIOUR AND THE FITNESS OF FISH Ph.D. Thesis - Cologne Univ. [DIE EXOGENE UND ENDOGENE STEUERUNG DES AKTIVITAETSVERHALTENS UND DIE LEISTUNGSFAEHIGKEIT VON FISCHEN]
Dieter Seibt (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany, F.R.) Apr. 1992 156 p Transl. into ENGLISH of Die Exogene und Endogene Steuerung des Aktivitaetsverhaltens und die Leistungsfaehigkeit von Fischen (Cologne, Fed. Republic of Germany, DLR), 1990 161 p Original language document was announced as N90-29766
(ESA-TT-1221; DLR-FB-90-14; ETN-92-91962) Avail: CASI HC A08/MF A02; DLR, Wissenschaftliches Berichtswesen, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC

The activity behavior of goldfish was examined under various light conditions. Under LL and DD only a few indications of endogenous components were found. In most cases the behavior was random and could be characterized by its exponential functions. LD (Light/Darkness) cycles differing from 24 hours demonstrated the influence of the exogenous factors in activity. The dorsal light reation of the guppy was used for a fitness and performance test. Fish were vertically arranged and thus light orientation was separated from gravity orientation. Quality precision and speed of the orientation reactions after changes in the angle of incident light were measured and the reactions examined for periodical variations. ESA

N92-34004# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna.
EXAMINATION OF NITROGEN FIXATION BY LEGUMINOSES AND ITS SECONDARY EFFECT ON GRAINS USING N-15 [UNTERSUCHUNG DER STICKSTOFFIXIERUNG DURCH LEGUMINOSEN UND DEREN NACHWIRKUNG AUF GETREIDE MITTELS 15N]
Mohamed K. Elwaraky (Agricultural Research Station, Mallawy, Egypt) and Ernst Haunold May 1991 9 p Repr. from VDLUFA-Schriftenreihe 30 (Bayreuth, Fed. Republic of Germany), 1990 p 135-140 In GERMAN Presented at the 101th Verband Deutscher Landwirtschaftlicher Untersuchungs- und Forschungsanstalten Ordnungsgemaesse Landwirtschaft, Bayreuth, Fed. Republic of Germany, 18-23 Sep. 1989
(OEFZS-4580; ETN-92-91339) Copyright Avail: CASI HC A02/MF A01

The leguminoses showed the greatest nitrogen fixation at low supply of manure nitrogen. The fixed air nitrogen amounted to 95 percent in beans, 86 percent in peas, and 65 percent in barley, as related to the total nitrogen. The fixation efficiency dropped with increasing manure, and the manure nitrogen absorption rose. The secondary effects of fixed air nitrogen on spring wheat led to an increase on efficiency of 68, 66, and 47 percent for peas, beans, and barley, respectively, with regard to spring barley spring wheat crop rotation. ESA

N92-34138# Norwegian Defence Research Establishment, Kjeller.
AUTONOMIC CHOLINERGIC NEUROTRANSMISSION IN THE RESPIRATORY SYSTEM: EFFECT OF ORGANOPHOSPHATE POISONING AND ITS TREATMENT Ph.D. Thesis - Oslow Univ., 1991
Per Walday 20 May 1992 105 p
(Contract DAMD17-87-G-7004)
(NDRE/PUBL-92/1002) Avail: CASI HC A06/MF A02

The present study has shown that the organophosphate anticholinesterase soman inhibits the acetylcholinesterase (AChE), butyrylcholinesterase (BuChE), and carboxylesterase (CarbE) activities in the respiratory system in vitro (rat and guinea pig) and in vivo after inhalation exposure (rat). The rat and guinea pig in vitro brochial smooth muscle response, and the rat ex vivo tracheal response to nerve-mediated stimulation, were substantially inhibited by soman. This was probably due to an increased basal tone of the smooth muscle, induced by decreased inactivation and subsequent accumulation of acetylcholine (ACh) in the neuroeffector junctions. In vitro bronchial contractions induced by histamine in guinea pig were, however, not affected by soman, indicating that soman does not affect the airway smooth muscle itself but only the cholinergic system. During inhalation with soman, CarbE both in the respiratory system and plasma may function as a detoxifying scavenger. Author

N92-34229* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
THREE-DIMENSIONAL CO-CULTURE PROCESS Patent
David A. Wolf, inventor (to NASA) and Thomas J. Goodwin, inventor (to NASA) 6 Oct. 1992 6 p Filed 2 Mar. 1989 Supersedes N90-18852 (28 - 11, p 1538) Continuation-in-part of US-Patent-Appl-SN-213558, filed 30 Jun. 1988 and continuation-in-part of US-Patent-Appl-SN-213559, filed 30 Jun. 1988 and continuation-in-part of US-Patent-Appl-SN-317776, filed 2 Mar. 1989
(NASA-Case-MSC-21560-1; US-Patent-5,153,132; US-Patent-Appl-SN-317931; US-Patent-Appl-SN-213558; US-Patent-Appl-SN-213559; US-Patent-Appl-SN-317776; US-Patent-Class-435-240.24; US-Patent-Class-435-3; US-Patent-Class-435-240.25; US-Patent-Class-435-286) Avail: US Patent and Trademark Office

The present invention relates to a 3-dimensional co-culture process, more particularly to methods or co-culturing at least two types of cells in a culture environment, either in space or in unit gravity, with minimum shear stress, freedom for 3-dimensional spatial orientation of the suspended particles and localization of particles with differing or similar sedimentation properties in a similar spatial region to form 3-dimensional tissue-like structures. Several examples of multicellular 3-dimensional experiences are included. The protocol and procedure are also set forth. The process allows simultaneous culture of multiple cell types and supporting substrates in a manner which does not disrupt the 3-dimensional spatial orientation of these components. The co-cultured cells cause a mutual induction effect which mimics the natural hormonal signals and cell interactions found in the intact organism. This causes the tissues to differentiate and form higher 3-dimensional structures such as glands, junctional complexes polypoid geometries, and microvilli which represent the corresponding in-vitro

structures to a greater degree than when the cell types are cultured individually or by conventional processes. This process was clearly demonstrated for the case of two epithelial derived colon cancer lines, each co-cultured with normal human fibroblasts and with microcarrier bead substrates. The results clearly demonstrate increased 3-dimensional tissue-like structure and biochemical evidence of an increased differentiation state. With the present invention a variety of cells may be co-cultured to produce tissue which has 3-dimensionality and has some of the characteristics of in-vitro tissue. The process provides enhanced 3-dimensional tissue which create a multicellular organoid differentiation model.

Official Gazette of the U.S. Patent and Trademark Office

N92-34231* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

THREE-DIMENSIONAL CELL TO TISSUE ASSEMBLY PROCESS Patent

David A. Wolf, inventor (to NASA), Ray P. Schwarz, inventor (to NASA), Marian L. Lewis, inventor (to NASA), John H. Cross, inventor (to NASA), and Mary H. Huls, inventor (to NASA) 13 Oct. 1992 16 p Filed 2 Mar. 1989 Supersedes N91-13860 (29 - 5, p 693) Continuation-in-part of US-Patent-Appl-SN-213558, filed 30 Jun. 1988 and continuation-in-part of US-Patent-Appl-SN-213559, filed 30 Jun. 1988
(NASA-Case-MSC-21559-1; US-Patent-5,155,034; US-Patent-Appl-SN-317776; US-Patent-Appl-SN-213558; US-Patent-Appl-SN-213559; US-Patent-Class-435-240.24; US-Patent-Class-435-3; US-Patent-Class-435-240.25; US-Patent-Class-435-286; US-Patent-Class-435-312) Avail: US Patent and Trademark Office

The present invention relates a 3-dimensional cell to tissue and maintenance process, more particularly to methods of culturing cells in a culture environment, either in space or in a gravity field, with minimum fluid shear stress, freedom for 3-dimensional spatial orientation of the suspended particles and localization of particles with differing or similar sedimentation properties in a similar spatial region. Official Gazette of the U.S. Patent and Trademark Office

N92-34232* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

HIGH ASPECT REACTOR VESSEL AND METHOD OF USE Patent

David A. Wolf, inventor (to NASA), Clarence F. Sams, inventor (to NASA), and Ray P. Schwarz, inventor (to NASA) 6 Oct. 1992 10 p Filed 11 Dec. 1990 Supersedes N91-17531 (29 - 3, p 313)
(NASA-Case-MSC-21662-1; US-Patent-5,153,131; US-Patent-Appl-SN-625345; US-Patent-Class-435-240.240; US-Patent-Class-435-284; US-Patent-Class-435-286; US-Patent-Class-435-311; US-Patent-Class-435-312; US-Patent-Class-435-313; US-Patent-Class-435-315) Avail: US Patent and Trademark Office

An improved bio-reactor vessel and system useful for carrying out mammalian cell growth in suspension in a culture media are presented. The main goal of the invention is to grow and maintain cells under a homogeneous distribution under acceptable biochemical environment of gas partial pressures and nutrient levels without introducing direct agitation mechanisms or associated disruptive mechanical forces. The culture chamber rotates to maintain an even distribution of cells in suspension and minimizes the length of a gas diffusion path. The culture chamber design is presented and discussed.

Official Gazette of the U.S. Patent and Trademark Office

N92-33465# Nottingham Univ. (England). Dept. of Life Science.

BIOLOGY AND TELESCIENCE

L. G. Briarty *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 53-57 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

N92-33863# Nagoya Univ. (Japan). Dept. of Aerospace Physiology.

RESULT OF AIRCRAFT EXPERIMENTS

Satoru Watanabe *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 141-146 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N92-33254# Air Force Inst. of Tech., Wright-Patterson AFB, OH.

MUSCULAR STRENGTH GAINS AND SENSORY PERCEPTION CHANGES: A COMPARISON OF ELECTRICAL AND COMBINED ELECTRICAL/MAGNETIC STIMULATION M.S. Thesis

Robert S. Wainner 10 Apr. 1992 142 p
(AD-A252609; AFIT/CI/CIA-92-013) Avail: CASI HC A07/MF A01

The purpose of this study was to compare the strengthening effect and sensory perception (pain and perceived contraction intensity) associated with electrical (NMES) and combined electrical/magnetic (PMEF) stimulation on healthy subjects. Subjects were randomly assigned to either an NMES Group (N = 21) or a PMEF (N = 19) Group. All subjects were blind to group assignment and their opposite limb was used as the control. Subjects completed a familiarization session and were tested the following day to determine the peak torque of the quadriceps femoris muscles of both limbs. The NMES group and PMEF group underwent training that consisted of ten, ten-second induced contractions, repeated three times per week. GRA

N92-33650# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.

VIDEO OCULOGRAPHIC: REGISTRATION OF EYE MOVEMENTS IN THREE DEGREES OF FREEDOM FOR RESEARCH AND MEDICAL DIAGNOSIS OF THE EQUILIBRIUM SYSTEM Ph.D. Thesis [VIDEO-OKULOGRAPHIE: REGISTRIERUNG VON AUGENBEWEGUNGEN IN DREI FREIHEITSGRADEN ZUR ERFORSCHUNG UND MEDIZINISCHEN DIAGNOSTIK DES GLEICHGEWICHTSSYSTEMS]

Winfried Teiwes 1991 162 p In GERMAN
(ETN-92-92128) Avail: CASI HC A08/MF A02

The Video OculoGraphic (VOG) method is presented, as a way of registering eye movements in three dimensions. It allows a dynamic registration of eye movements. The algorithm used and the implementation are described. VOG is compared with other video based processes for eye movement registration. It is shown that eye observation is not possible using other quantitative methods. Experiments are carried out, with a view to examining the dynamic behavior of eye torsion in short time weightlessness and in high gravity conditions. The results emphasize the significance of eye torsion and of this measurement method for clinical diagnosis. ESA

N92-33657*# George Washington Univ., Washington, DC.

PUBLICATIONS OF THE SPACE PHYSIOLOGY AND COUNTERMEASURES PROGRAM, REGULATORY PHYSIOLOGY DISCIPLINE: 1980 - 1990

Janice Wallace-Robinson, Katherine J. Dickson, Elizabeth Hess, and Janet V. Powers Sep. 1992 105 p
(Contract NASw-4324)
(NASA-CR-4469; NAS 1.26:4469) Avail: CASI HC A06/MF A02

A 10-year cumulative bibliography of publications resulting from research supported by the Regulatory Physiology discipline of the Space Physiology and Countermeasures Program of NASA's Life

Sciences Division is provided. Primary subjects included in this bibliography are circadian rhythms, endocrinology, fluid and electrolyte regulation, hematology, immunology, metabolism and nutrition, temperature regulation, and general regulatory physiology. General physiology references are also included. Principal investigators whose research tasks resulted in publication are identified by asterisk. Publications are identified by a record number corresponding with their entry in the Life Sciences Bibliographic Database, maintained at the George Washington University.

Author

N92-33825*# Old Dominion Univ., Norfolk, VA. Dept. of Electrical and Computer Engineering.

SIGNAL PROCESSING METHODOLOGIES FOR AN ACOUSTIC FETAL HEART RATE MONITOR Final Report, 1 Jan. 1988 - 30 Sep. 1991

Robert A. Pretlow, III and John W. Stoughton Sep. 1992 105 p Original contains color illustrations

(Contract NCC1-120)

(NASA-CR-190828; NAS 1.26:190828) Avail: CASI HC A06/MF A02; 16 functional color pages

Research and development is presented of real time signal processing methodologies for the detection of fetal heart tones within a noise-contaminated signal from a passive acoustic sensor. A linear predictor algorithm is utilized for detection of the heart tone event and additional processing derives heart rate. The linear predictor is adaptively 'trained' in a least mean square error sense on generic fetal heart tones recorded from patients. A real time monitor system is described which outputs to a strip chart recorder for plotting the time history of the fetal heart rate. The system is validated in the context of the fetal nonstress test. Comparisons are made with ultrasonic nonstress tests on a series of patients. Comparative data provides favorable indications of the feasibility of the acoustic monitor for clinical use. Author

N92-33908# National Aerospace Medical Centre, Soesterberg (Netherlands). Afdel. Onderzoek en Ontwikkeling.

RADIATION EXPOSURE OF CIVIL AIR CARRIER CREWMEMBERS [STRALINGSBELASTING VAN VLIEGEND PERSONEEL IN DE BURGERLUCHTVAART]

M. Simons Oct. 1991 40 p In DUTCH

(NLRGC/B-1-4/91; ETN-92-92054) Avail: CASI HC A03/MF A01

The available knowledge on radiation exposure of civil aircraft crew members is reviewed. The mean additional radiation exposure of Dutch crew operating on intercontinental routes is estimated to be 3 to 6 mSv per annum, which after 20 years means an estimated risk of 2 to 5 in 1000 to die of occupational radiation related cancer, in addition to the normal expectation for the Dutch population that 250 to 300 in 1000 would die of cancer from causes unrelated to occupational radiation exposure. With respect to the regulatory aspects of radiation protection, it is recommended to consider these crew members as a special category. Possible measures for such a category are discussed. It is recommended that a commission be appointed in charge of the development and evaluation of directives for civil aircraft crews. ESA

N92-33927# Chicago Univ., IL. Dept. of Medicine.

PHASE-SHIFTING EFFECT OF LIGHT AND EXERCISE ON THE HUMAN CIRCADIAN CLOCK Annual Report, 1 Mar. 1991 - 29 Feb. 1992

Eve VanCauter 29 Feb. 1992 12 p

(Grant AF-AFOSR-0222-90)

(AD-A253012; AFOSR-92-0665TR) Avail: CASI HC A03/MF A01

In animals, the major environmental signal responsible for the entrainment of circadian rhythmicity to external time is the light-dark cycle. While for many years, it was thought that light did not play an important role in synchronizing human rhythms, and that social cues were the primary entraining agent, extensive evidence obtained during the past decade using light of greater intensity than in earlier studies has indicated that the light-dark cycle is also a major zeitgeber for human circadian rhythmicity. The evolution of concepts regarding zeitgebers for non-human mammalian rhythms ran in many ways opposite to that occurring in the field of human rhythms. Indeed, social and/or behavioral cues were long thought to be ineffective as zeitgebers in rodents and other mammals, but evidence has accumulated over the past few years to indicate that behavioral changes are indeed capable of inducing shifts in circadian rhythms. Specifically, stimuli which cause an alteration of the rest activity cycle, either by eliciting activity (i.e., locomotor activity in rodent studies) during the normal rest period or by preventing activity during the normal active period, result in phase shifts of circadian rhythms. These findings implied that physical activity during the usual rest period (i.e., nighttime) as well as sleep occurring during the normal active period (i.e., daytime) could alter the phase of human rhythms. GRA

N92-33928# Harvard Univ., Cambridge, MA.

COOPERATIVITY AND 3-D REPRESENTATION Annual Report, 1 Feb. 1991 - 1 Jan. 1992

Patrick Cavanagh 25 May 1992 5 p

(Grant AF-AFOSR-0169-91)

(AD-A253015; AFOSR-92-0652TR) Avail: CASI HC A01/MF A01

Recent evidence indicates that the early stages in visual processing may be broken into several parallel streams that are specialized for the analysis of different visual attributes. A contour localization task showed that all attributes can contribute equally to border localization - no particular attribute dominated position decisions. The position decision appeared to be determined in a common representation. In contrast to this common analysis, a study of visual persistence showed that motion-defined shapes have a visual persistence which lasts longer than, and appears to be independent of, the persistence for luminance-defined shapes. Because of the involvement of motion, the site of the persistence phenomenon must be cortical. A series of experiments on transparency perception showed that transparency is analyzed rapidly (within 60 msec) and influences early levels of visual processing. We have also investigated the early stages that lead from the initial 2-D representation to object recognition. Visual priming studies have been completed which suggest that object recognition begins, not with the construction of a 3-D model, but with a crude match of 2-D views to internal prototypes. The prototype that has the best match then guides the construction of an internal 3-D model. GRA

N92-34103# International Centre for Theoretical Physics, Trieste (Italy).

DEEP HEAT MUSCLE TREATMENT: A MATHEMATICAL MODEL, 1

A. Ogulu and A. R. Bestman (Port Harcourt Univ., Nigeria) Mar. 1992 20 p

(DE92-634084; IC-92/43) Avail: CASI HC A03/MF A01

The flow of blood during deep heat muscle treatment is studied. We model the blood vessel as a long tube in circular section whose radius varied slowly. Under the Boussinesq approximation, we seek asymptotic series expansions for the velocity components, temperature and pressure about a small parameter, (epsilon), characterizing the radius variation. The study reveals mathematically why physicians recommend a hot bath for cuts and physiotherapists use ice packs for bruises. DOE

N92-34104# International Centre for Theoretical Physics, Trieste (Italy).

DEEP HEAT MUSCLE TREATMENT: A MATHEMATICAL MODEL, 2

A. Ogulu and A. R. Bestman (Port Harcourt Univ., Nigeria) Mar. 1992 16 p

(DE92-634085; IC-92/44) Avail: CASI HC A03/MF A01

In this paper the effect of viscosity variation on the flow of blood during deep heat muscle treatment is studied. Two methods, an asymptotic series expansion technique and a perturbation technique, are employed to obtain the temperature distribution. The results are compared with the problem of Part 1. A novel

development in this part of the study is the combined asymptotic patching and matching technique. DOE

N92-34154*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TRACK STRUCTURE MODEL OF CELL DAMAGE IN SPACE FLIGHT
Robert Katz (Nebraska Univ., Lincoln.), Francis A. Cucinotta, John W. Wilson, Judy L. Shinn, and Duc M. Ngo (Old Dominion Univ., Norfolk, VA.) Oct. 1992 32 p
(RTOP 199-04-16-11)
(NASA-TP-3235; L-17058; NAS 1.60:3235) Avail: CASI HC A03/MF A01

The phenomenological track-structure model of cell damage is discussed. A description of the application of the track-structure model with the NASA Langley transport code for laboratory and space radiation is given. Comparisons to experimental results for cell survival during exposure to monoenergetic, heavy-ion beams are made. The model is also applied to predict cell damage rates and relative biological effectiveness for deep-space exposures. Author

N92-33464# State Univ. Hospital, Ballerup (Denmark). Inst. of Aerospace Medicine.
TELESCIENCE IN HUMAN PHYSIOLOGY
Niels Foldager, Nigel Wootton (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), and F. Bonde-Petersen (European Space Agency, Cologne, Germany, F.R.) *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 49-52 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N92-33390# Washington Univ., Seattle. Dept. of Psychology.
COMPUTERIZED ASSESSMENT OF INDIVIDUAL DIFFERENCES Final Report, 1 Oct. 1987 - 30 Jan. 1991
Earl B. Hunt 29 Aug. 1991 35 p
(Contract N00014-86-C-0065)
(AD-A252801) Avail: CASI HC A03/MF A01

Co-ordinating ability is the ability to integrate information from several domains in order to accomplish a single task. An example is integrating verbal instructions with visual perception of scenes. We have found that coordinating ability in linguistic and perceptual tasks is an ability that is over and above the ability to deal with linguistic or perceptual tasks alone. A related study analyzed orienting ability, i.e., the ability to locate oneself in large-scale space. Orienting requires the integration of information from a succession of visual scenes. This ability was shown to depend upon the ability to form and unite surveyor's representations of different scenes, given the information in a ground plane view. Orienting ability was studied by contrasting the abilities of college students (novices) and sports orienteers, including international competitors. GRA

N92-33433# Universal Energy Systems, Inc., Dayton, OH.
PERSONALITY THEORY FOR AIRCREW SELECTION AND CLASSIFICATION Final Report, Nov. 1990 - Nov. 1991
Larry A. Pedersen, Karla E. Allan, Francis J. Laue, James R. Johnson, and Frederick M. Siem May 1992 49 p
(Contract F41689-86-D-0052)
(AD-A253045; AL-TR-1992-0021) Avail: CASI HC A03/MF A01

Growing acceptance of a taxonomy of personality traits developed by the Air Force in the late 1950's (Tupes and Christal, 1961) has prompted a reexamination of the utility of personality measures for aircrew selection and classification research. Candidate theories are identified and then evaluated according both to general scientific criteria and to specific operational criteria (e.g., Hall and Lindzey, 1978; Imhoff and Levine, 1981). The Five Factor Model (Goldberg, 1990; McCrae and Costa, 1985; Tupes and Christal, 1961) is selected as the most suitable framework for guiding future Air Force research in the personality domain. Example items to measure relevant characteristics are proposed, as are directions for future research. GRA

N92-33588# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
FATIGUE EFFECTS ON GROUP PERFORMANCE, GROUP DYNAMICS, AND LEADERSHIP
Emoke Jozsvai and Ron Heslegrave Nov. 1991 44 p
(DCIEM-91-70; CTN-92-60568) Avail: CASI HC A03/MF A01

Three groups of four subjects were exposed to 64 hours of sleep deprivation. Group problem solving, group dynamics, cognitive abilities, and subjective well-being were assessed over eleven 15 minute sessions during which each group had to solve a syllogism. The speed of group problem solving did not change as a function of sleep deprivation. However, subjects did not contribute equally to the solution of the syllogisms. Behavioral observations revealed that within each group, one or two subjects rotated task leadership in verbal syllogism problem solving. Neither individual cognitive abilities nor individual states of well-being were systematically related to the allocation of individual group problem solving efforts. Regarding group interactions, intra-group hostility remained low and the group atmosphere was positive throughout the experiment. These results suggest that group performance of complex cognitive tasks can be maintained under conditions of extreme fatigue even though individual abilities and well being have been severely degraded. The data suggest that the maintenance of group performance is dependent both on some group members becoming task leaders and on a positive group atmosphere, which allows non-leaders to temporarily assume task leadership when task leaders are incapacitated. Author (CISTI)

N92-34076# California Univ., Berkeley. Lawrence Berkeley Lab.
QUANTUM CONCEPTION OF MAN
H. P. Stapp Apr. 1992 12 p Presented at the 3rd UNESCO Science and Culture Forum: Toward Eco-Ethics-Alternative Visions of Culture, Science, Technology and Nature, Belem, Brazil, 5-10 Apr. 1992
(Contract DE-AC03-76SF-00098)
(DE92-017080; LBL-32043; CONF-9204173-1) Avail: CASI HC A03/MF A01

This report discusses the quantum processes of the brain and the relationship that this process has on man's behavior. DOE

N92-34184# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.
META ANALYSIS OF AIRCRAFT PILOT SELECTION MEASURES
David R. Hunter and Eugene F. Burke Jun. 1992 40 p
(AD-A253387; ARI-RN-92-51) Avail: CASI HC A03/MF A01

For this research, the meta-analytic procedures described by earlier researchers were applied to a database of 476 correlations based on an overlapping sample of 432,324 cases. These correlations were obtained from a review of the research literature on aircrew selection published from 1920 to 1990. Over 200 studies that dealt with aircrew selection were identified. Of that number, 69 reported correlations between some independent measure and a pilot training performance criterion. Analyses were conducted of the overall aggregated set of correlations and subsets selected on the basis of date of study, type of predictor measure, type of aircraft, and sample characteristics. These analyses showed a decline in the mean validity correlations obtained over the previous 50 years. In addition, differences in the mean correlations were observed among the various types of predictor measures. In general, job sample measures were the best predictors of

performance, followed by psychomotor coordination and biographical inventories. Possible applications of the results in the interpretation of previous research and in the design of future research are discussed. GRA

N92-34234*# Virginia Univ., Charlottesville. Dept. of Psychology.
PERCEPTUAL ADAPTATION IN THE USE OF NIGHT VISION GOGGLES Final Technical Report, Jun. 1991 - May 1992
Frank H. Durgin and Dennis R. Proffitt May 1992 21 p
(Grant NAG2-721)
(NASA-CR-190572; NAS 1.26:190572) Avail: CASI HC A03/MF A01

The image intensification (I sup 2) systems studied for this report were the biocular AN/PVS-7(NVG) and the binocular AN/AVS-6(ANVIS). Both are quite impressive for purposes of revealing the structure of the environment in a fairly straightforward way in extremely low-light conditions. But these systems represent an unusual viewing medium. The perceptual information available through I sup 2 systems is different in a variety of ways from the typical input of everyday vision, and extensive training and practice is required for optimal use. Using this sort of system involves a kind of perceptual skill learning, but is may also involve visual adaptations that are not simply an extension of normal vision. For example, the visual noise evident in the goggles in very low-light conditions results in unusual statistical properties in visual input. Because we had recently discovered a strong and enduring aftereffect of perceived texture density which seemed to be sensitive to precisely the sorts of statistical distortions introduced by I sup 2 systems, it occurred to use that visual noise of this sort might be a very adapting stimulus for texture density and produce an aftereffect that extended into normal vision once the goggles were removed. We have not found any experimental evidence that I sup 2 systems produce texture density aftereffects. The nature of the texture density aftereffect is briefly explained, followed by an accounting of our studies of I sup 2 systems and our most recent work on the texture density aftereffect. A test for spatial frequency adaptation after exposure to NVG's is also reported, as is a study of perceived depth from motion (motion parallax) while wearing the biocular goggles. We conclude with a summary of our findings. Author

N92-33856# National Space Development Agency, Tokyo (Japan). Space Station Program Dept.
JEM DEVELOPMENT STATUS AND PLAN FOR JEM CREW TRAINING
Kazuhiko Yoneyama *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 31-47 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

N92-33886*# Wyle Labs., Inc., El Segundo, CA.
EVALUATION OF HUMAN RESPONSE TO STRUCTURAL VIBRATION INDUCED BY SONIC BOOM
L. C. Sutherland and J. Czech *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 171-195 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N92-33660# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
HUMAN FACTORS IN THE CF-18 PILOT ENVIRONMENT [LES FACTEURS HUMAINE PROPRES A L'ENVIRONNEMENT DES PILOTES DE CF-18]
R. A. Davidson, D. Beevis, F. Buick, A. L. M. Donati, L. Kantor, S. H. R. Bannister, E. A. Brook, J. A. P. Rochefort, and J. R. Turner Jan. 1991 293 p In ENGLISH and FRENCH
(DCIEM-91-11; CTN-92-60591) Avail: CASI HC A13/MF A03

A review of human factors in the CF-18 pilot environment was undertaken via a survey of 161 active CF-18 pilots. Over 300 human factors issues were initially identified, of which the 88 most relevant to CF-18 operations were selected and evaluated. The pilots were asked to assess, from a squadron perspective, the current effect of each issue on flight safety and operational effectiveness. Each issue was rated on a sliding scale and ratings were analyzed using a non-parametric procedure. Aircraft and aircraft operations issues were rated almost equally divided between beneficial and neutral. Most of the training related issues were rated as beneficial. Among issues related to squadron personnel, comparable numbers received beneficial, neutral, and detrimental ratings. A fourth of the organizational issues were rated as detrimental, with most of the rest rated as neutral. In general, issues beneficial to flight safety were also beneficial to operational effectiveness. Cause and effect models were developed to explain the ratings, supporting the opinion that the greatest threats to flight safety and operational effectiveness are the decreasing level of flying experience and inadequate manning levels. Specific conclusions and recommendations are presented for improving flight safety and operational effectiveness. Author (CISTI)

N92-33832 National Physical Lab., Teddington (England). Radiation Science and Acoustics Div.
ALVEY MAN-MACHINE INTERFACE PROJECT MMI/132 SPEECH TECHNOLOGY ASSESSMENT Final Report
M. J. Goldsmith and H. C. Fuller Nov. 1991 28 p
(NPL-RSA(EXT)-26; ETN-92-91984) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

The work of the Alvey speech technology assessment project to investigate aspects of the automated assessment of the performance of speech recognizers is summarized. The technical activities and major achievements of the project are outlined, and a bibliography of the detailed papers covering work carried out for the project is included. ESA

N92-33987# EG and G Energy Measurements, Inc., Idaho Falls. National Engineering Lab.
REVIEWING THE IMPACT OF ADVANCED CONTROL ROOM TECHNOLOGY
C. A. Wilhelmsen, D. I. Gertman, L. T. Ostrom, W. R. Nelson, W. J. Galyean, and J. C. Byers 1992 4 p Presented at the 5th Conference on Human Factors and Power Plants: Power Generation - The Next Decade and Beyond, Monterey, CA, 7-11 Jun. 1992
(Contract DE-AC07-76ID-01570)
(DE92-018032; EGG-M-91550; CONF-9206106-1) Avail: CASI HC A01/MF A01

Progress to date on assessing the nature of the expected changes in human performance and risk associated with the introduction of digital control, instrumentation, and display systems is presented. Expected changes include the shift toward more supervisory tasks, development of intervention strategies, and reallocation of function between human and machine. Results are reported in terms of the scope of new technology, human performance issues, and crews experience with digital control

systems in a variety of industries petrochemical and aerospace. Plans to conduct a limited Probabilistic Risk Assessment/Human Reliability Assessment (PRA/HRA) comparison between a conventional NUREG-1150 series plant and that same plant retrofit with distributed control and advanced instrumentation and display are also presented. Changes needed to supplement existing HRA modeling methods and quantification techniques are discussed.
DOE

N92-34016# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).
INTEGRATION OF AN INTEGRATED HELMET SYSTEM FOR PAH2
Hans Dieter Viktor Boehm (Eurocopter Deutschland G.m.b.H., Munich, Germany, F.R.) and Herbert Schreyer (Eurocopter Deutschland G.m.b.H., Munich, Germany, F.R.) 1992 13 p Presented at the Royal Aeronautical Society Avionics Systems Group Conference on IR Sensors, London, England, 18 Feb. 1992
(MBB-UD-0615-92-PUB; ETN-92-92110) Avail: CASI HC A03/MF A01

Tests results and PAH2 (second generation Tiger antitank helicopter) integration aspects of a modern Integrated Helmet System (IHS) are presented. The IHS consists of a helmet shell, a Helmet Mounted Sight (HMS), two Image Intensifier Tubes (IIT), and two Cathode Ray Tubes (CRT), with an optical system including combiners to present binocular images. Additional symbology can be superimposed to the CRT or IIT image. An IHS is a further development of a Helmet Mounted Display (HMD) to cope with mode demanding requirements regarding ergonomics and operability under adverse visual conditions. The HMS can steer a sensor platform with a thermal camera or an air to air missile system. The aim helicopter (HC) requirements on such a system are: human factors; fit of helmet including optimized center of gravity (CG) and weight; optimized day, twilight, and night optical modules; large exit pupil, good transmission of the optical path and a large adjustment range; good geometrical resolution/Modulation Transfer Function (MTF) with a large Field of View (FOV); high focusing range of the IIT and a good S/N ratio below 1 mLux; CRT automatic brightness and constrast control with a good readability on day time; flight symbology presentation for one or two eyes; good static and dynamic HMS accuracy with a large Head Motion Box (HMB); and NBC and laser protection compatibility.
ESA

N92-34022*# Sterling Federal Systems, Inc., Palo Alto, CA.
ARMY-NASA AIRCREW/AIRCRAFT INTEGRATION PROGRAM. PHASE 5: A3I MAN-MACHINE INTEGRATION DESIGN AND ANALYSIS SYSTEM (MIDAS) SOFTWARE CONCEPT DOCUMENT
Carolyn Banda, David Bushnell, Scott Chen, Alex Chiu, Christian Neukom, Sayuri Nishimura, Michael Prevost, Renuka Shankar, Lowell Staveland, and Greg Smith Jun. 1992 83 p
(Contract NAS2-13210)
(NASA-CR-177596; A-92137; NAS 1.26:177596) Avail: CASI HC A05/MF A01

This is the Software Concept Document for the Man-machine Integration Design and Analysis System (MIDAS) being developed as part of Phase V of the Army-NASA Aircrew/Aircraft Integration (A3I) Progam. The approach taken in this program since its inception in 1984 is that of incremental development with clearly defined phases. Phase 1 began in 1984 and subsequent phases have progressed at approximately 10-16 month intervals. Each phase of development consists of planning, setting requirements, preliminary design, detailed design, implementation, testing, demonstration and documentation. Phase 5 began with an off-site planning meeting in November, 1990. It is expected that Phase 5 development will be complete and ready for demonstration to invited visitors from industry, government and academia in May, 1992. This document, produced during the preliminary design period of Phase 5, is intended to record the top level design concept for MIDAS as it is currently conceived. This document has two main objectives: (1) to inform interested readers of the goals of the MIDAS Phase 5 development period, and (2) to serve as the initial version of the MIDAS design document which will be continuously updated as the design evolves. Since this document is written fairly early in the design period, many design issues still remain unresolved. Some of the unresolved issues are mentioned later in this document in the sections on specific components. Readers are cautioned that this is not a final design document and that, as the design of MIDAS matures, some of the design ideas recorded in this document will change. The final design will be documented in a detailed design document published after the demonstrations.
Author

N92-34179*# Lockheed Engineering and Sciences Co., Houston, TX.
THE EFFECT OF A REDUNDANT COLOR CODE ON AN OVERLEARNED IDENTIFICATION TASK
Kevin OBrien Washington Oct. 1992 30 p Sponsored by NASA. Lyndon B. Johnson Space Center
(Contract NAS9-17900)
(NASA-CR-4445; S-679; NAS 1.26:4445; LESC-28803) Avail: CASI HC A03/MF A01

The possibility of finding redundancy gains with overlearned tasks was examined using a paradigm varying familiarity with the stimulus set. Redundant coding in a multidimensional stimulus was demonstrated to result in increased identification accuracy and decreased latency of identification when compared to stimuli varying on only one dimension. The advantages attributable to redundant coding are referred to as redundancy gain and were found for a variety of stimulus dimension combinations, including the use of hue or color as one of the dimensions. Factors that have affected redundancy gain include the discriminability of the levels of one stimulus dimension and the level of stimulus-to-response association. The results demonstrated that response time is in part a function of familiarity, but no effect of redundant color coding was demonstrated. Implications of research on coding in identification tasks for display design are discussed.
Author

N92-34209*# National Aeronautics and Space Administration, Washington, DC.
STRATEGIC CONSIDERATIONS FOR SUPPORT OF HUMANS IN SPACE AND MOON/MARS EXPLORATION MISSIONS. LIFE SCIENCES RESEARCH AND TECHNOLOGY PROGRAMS, VOLUME 1
Jun. 1992 155 p
(NASA-TM-107983; NAS 1.15:107983) Avail: CASI HC A08/MF A02

During the next several decades, our nation will embark on human exploration in space. In the microgravity environment we will learn how human physiology responds to the absence of gravity and what procedures and systems are required to maintain health and performance. As the human experience is extended for longer periods in low Earth orbit, we will also be exploring space robotically. Robotic precursor missions, to learn more about the lunar and Martian environments will be conducted so that we can send crews to these planetary surfaces to further explore and conduct scientific investigations that include examining the very processes of life itself. Human exploration in space requires the ability to maintain crew health and performance in spacecraft, during extravehicular activities, on planetary surfaces, and upon return to Earth. This goal can only be achieved through focused research and technological developments. This report provides the basis for setting research priorities and making decisions to enable human exploration missions.
Author

N92-34210*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
GLOVE ATTACHMENT Patent Application
Frederic Dawn, inventor (to NASA), Walter Guy, inventor (to NASA), Joseph Kosmo, inventor (to NASA), Arthur Drennan, inventor (to NASA) (Little, Arthur D., Inc., Cambridge, MA), and Richard Tschirch, inventor (to NASA) (Little, Arthur D., Inc., Cambridge,

MA) 14 Aug. 1992 13 p
(NASA-Case-MSC-21632-1; NAS 1.71:MSC-21632-1; US-Patent-Appl-SN-929556) Avail: CASI HC A03/MF A01

An attachment principally for the palm of an astronaut glove to enhance the gripping area of the palm without detracting from the flexibility and utility of the glove is presented. The attachment is a composite construction formed from a layer of silicone rubber having an outer surface with a friction configuration and another layer of silicone rubber in which a Nomex Aramid mesh fabric is embedded prior to curing. The method of construction involves the use of a mold with a friction configuration surface. A first layer of silicone rubber or sealant is disposed in the mold and allowed to set for an hour. A second layer of silicone rubber or sealant is layered over the first layer and leveled. A Nomex Aramid mesh fabric is embedded into the second layer and the composite is permitted to cure. When cured, a configured area of the composite construction is glued or stitched to the palm area of the glove. NASA

N92-34211*# National Aeronautics and Space Administration, Washington, DC.
STRATEGIC CONSIDERATIONS FOR SUPPORT OF HUMANS IN SPACE AND MOON/MARS EXPLORATION MISSIONS. LIFE SCIENCES RESEARCH AND TECHNOLOGY PROGRAMS, VOLUME 2
Jun. 1992 442 p
(NASA-TM-107984; NAS 1.15:107984) Avail: CASI HC A19/MF A04

Summary charts of the following topics are presented: the Percentage of Critical Questions in Constrained and Robust Programs; the Executive Committee and AMAC Disposition of Critical Questions for Constrained and Robust Programs; and the Requirements for Ground-based Research and Flight Platforms for Constrained and Robust Programs. Data Tables are also presented and cover the following: critical questions from all Life Sciences Division Discipline Science Plans; critical questions listed by category and criticality; all critical questions which require ground-based research; critical questions that would utilize spacelabs listed by category and criticality; critical questions that would utilize Space Station Freedom (SSF) listed by category and criticality; critical questions that would utilize the SSF Centrifuge; facility listed by category and criticality; critical questions that would utilize a Moon base listed by category and criticality; critical questions that would utilize robotic missions listed by category and criticality; critical questions that would utilize free flyers listed by category and criticality; and critical questions by deliverables. Author

N92-33345*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
FIRST LUNAR OUTPOST CREW MODULE THERMAL PROTECTION DESIGN SENSITIVITY
Stan Bouslog (Lockheed Engineering and Sciences Co., Houston, TX.), Bill Rochelle (Lockheed Engineering and Sciences Co., Houston, TX.), Stan Williams (Lockheed Engineering and Sciences Co., Houston, TX.), Joe Caram, Don Curry, Steve Derry, and Matt Ondler *In its* Third SEI Technical Interchange: Proceedings 1992 p 555-569 (For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33346*# Martin Marietta Corp., Denver, CO.
SPACE HABITATION AND OPERATIONS MODULE (SHOM)
Ralph Eberhardt *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 570-576 (For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

N92-33348*# Tracor, Inc., Austin, TX.
PNEUMATICALLY ERECTED RIGID HABITAT
Bradley Salles *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 592-596 (For primary document see N92-33309 24-12)
Avail: CASI HC A01/MF A05

N92-33757# Kawasaki Heavy Industries Ltd., Kobe (Japan).
REVIEW ON LIFE SUPPORT TECHNOLOGIES IN EXTRA-VEHICULAR ACTIVITY TECHNOLOGY [SENGAI KATSUDOU GIJUTSU NI OKERU SEIMEI IJI GIJUTSU NO KENTOU]
Hiroyuki Torii *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33758# Takenaka Works, Osaka (Japan).
FUNDAMENTAL EXPERIMENTS OF SHOWER DEVELOPMENT FOR SPACE USE [UCHUU YOU SHAWA NO KAIHATSU NI KANSURU KISO JIKKEN]
Noriyuki Takahashi, Kenichi Unno, Kaoru Ootsuji (Mitsubishi Heavy Industries Ltd., Tokyo, Japan), and Takeshi Miyamoto (Mitsubishi Heavy Industries Ltd., Tokyo, Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 8 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

N92-33780# Nippon Electric Co. Ltd., Tokyo (Japan).
ECLSS EXPERIMENTS AT MANNED LUNAR SURFACE SITES [GETSUMEN YUUJIN KYOTEN NI OKERU ECLSS JIKKEN]
Toshimitsu Kanemura, Jun Inagaki, and Shigeru Oono *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 19 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33782# Toshiba Corp., Tokyo (Japan).
REVIEW ON HABITABILITY AT MANNED LUNAR SURFACE SITES [YUUJIN GETSUMEN KYOTEN NI OKERU KYOJUUSEI NO KENTOU]
Kouichi Furukawa *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 15 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N92-33630*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
OPTIMISTIC BARRIER SYNCHRONIZATION Final Report
David M. Nicol (Rutgers Univ., New Brunswick, NJ.) Jul. 1992 23 p Submitted for publication
(Contract NAS1-18605; NAG1-1060; NAG1-1132; NAG1-995; NSF ASC-88-19373; NSF CCR-92-01195; RTOP 505-90-52-01)
(NASA-CR-189684; NAS 1.26:189684; ICASE-92-34) Avail: CASI HC A03/MF A01

Barrier synchronization is fundamental operation in parallel computation. In many contexts, at the point a processor enters a barrier it knows that it has already processed all the work required of it prior to synchronization. The alternative case, when a processor cannot enter a barrier with the assurance that it has

already performed all the necessary pre-synchronization computation, is treated. The problem arises when the number of pre-sychronization messages to be received by a processor is unkown, for example, in a parallel discrete simulation or any other computation that is largely driven by an unpredictable exchange of messages. We describe an optimistic O(log sup 2 P) barrier algorithm for such problems, study its performance on a large-scale parallel system, and consider extensions to general associative reductions as well as associative parallel prefix computations.
Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N92-33412# Naval Air Warfare Center, Warminster, PA. Mission Avionics Technology Dept.
CD-ROM LABELING TECHNIQUES Technical Report, Jan. - Dec. 1991
Ronald Kushnier 6 Jan. 1992 15 p
(NR Proj. RS2-1500)
(AD-A252845; NAWCADWAR-TN-92001-50) Avail: CASI HC A03/MF A01

This report provides experimental techniques for CD-ROM labeling. The Naval Air Warfare Center is currently involved in CD-ROM development for the United States military. Labeling techniques for Government CD-ROM discs require careful selection and design for the reasons outlined in this report. A CD-ROM disc is manufactured by injecting or pressing a polycarbonate material with microscopic pits in one continuous spiral pattern. A reflective layer of aluminum or gold is then deposited over the polycarbonate. Then a protective layer of material such as DIC-17 is spun across the surface of the metal. And, finally, for product-type CD's, a label is 'Print Screened' onto the finished product. It was found that the quality of CD-ROM discs vary greatly as to the producer's manufacturing process, top-coating protective material, and labeling techniques. Ineffective seal coat material and it's application has been shown to be the 'weak link' in CD-ROM longevity. Disc failure has resulted from penetration of contaminants into the metalized reflective layer. Some manufacturers metalize their discs to the edges, thereby not providing a hermetic seal to the environment. Improper silk screen and labeling inks can produce a migration effect into the metalized layer, thereby destroying the disk.
GRA

N92-33487*# TRW, Inc., Huntsville, AL. System Development Div.
SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY FOR NASA/MSFC. VOLUME 1: BASELINE ARCHITECTURE REPORT Study Report, Jan. - Dec. 1990
21 Dec. 1990 113 p Prepared in cooperation with Essex Corp., Huntsville, AL and Grumman Data Systems Corp., Woodbury, NY
(Contract NAS8-37745)
(NASA-CR-184368; NAS 1.26:184368; TRW-SCS-90-XT2-Vol-1)
Avail: CASI HC A06/MF A02

NASA's Space Station Freedom Program (SSFP) planning efforts have identified a need for a payload training simulator system to serve as both a training facility and as a demonstrator to validate operational concepts. The envisioned MSFC Payload Training Complex (PTC) required to meet this need will train the Space Station payload scientists, station scientists, and ground controllers to operate the wide variety of experiments that will be onboard the Space Station Freedom. The Simulation Computer System (SCS) is made up of the computer hardware, software, and workstations that will support the Payload Training Complex at MSFC. The purpose of this SCS Study is to investigate issues related to the SCS, alternative requirements, simulator approaches, and state-of-the-art technologies to develop candidate concepts and designs.
Author

N92-33488*# TRW, Inc., Huntsville, AL. System Development Div.
SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY FOR NASA/MSFC. VOLUME 2: BASELINE ARCHITECTURE REPORT Study Report, Jan. - Dec. 1990
21 Dec. 1990 69 p Prepared in cooperation with Essex Corp., Huntsville, AL and Grumman Data Systems Corp., Woodbury, NY
(Contract NAS8-37745)
(NASA-CR-184369; NAS 1.26:184369; TRW-SCS-90-XT2-Vol-2)
Avail: CASI HC A04/MF A01

NASA's Space Station Freedom Program (SSFP) planning efforts have identified a need for a payload training simulator system to serve as both a training facility and as a demonstrator to validate operational concepts. The envisioned MSFC Payload Training Complex (PTC) required to meet this need will train the Space Station payload scientists, station scientists, and ground controllers to operate the wide variety of experiments that will be onboard the Space Station Freedom. The Simulation Computer System (SCS) is the computer hardware, software, and workstations that will support the Payload Training Complex at MSFC. The purpose of this SCS Study is to investigate issues related to the SCS, alternative requirements, simulator approaches, and state-of-the-art technologies to develop candidate concepts and designs.
Author

N92-33489*# TRW, Inc., Huntsville, AL. System Development Div.
SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY FOR NASA/MSFC. OPERATIONS CONCEPT REPORT Study Report, Jan. - Dec. 1990
21 Dec. 1990 45 p Prepared in cooperation with Essex Corp., Huntsville, AL and Grumman Data Systems Corp., Woodbury, NY
(Contract NAS8-37745)
(NASA-CR-184371; NAS 1.26:184371; TRW-SCS-90-XT4) Avail: CASI HC A03/MF A01

NASA's Space Station Freedom Program (SSFP) planning efforts have identified a need for a payload training simulator system to serve as both a training facility and as a demonstrator to validate operational concepts. The envisioned MSFC Payload Training Complex (PTC) required to meet this need will train the Space Station payload scientists, station scientists, and ground controllers to operate the wide variety of experiments that will be onboard the Space Station Freedom. The Simulation Computer System (SCS) is made up of computer hardware, software, and workstations that will support the Payload Training Complex at MSFC. The purpose of this SCS Study is to investigate issues related to the SCS, alternative requirements, simulator approaches, and state-of-the-art technologies to develop candidate concepts and designs.
Author

N92-33500# Research Triangle Inst., Research Triangle Park, NC.
INTEGRATION OF TOOLS FOR THE DESIGN AND ASSESSMENT OF HIGH-PERFORMANCE, HIGHLY RELIABLE COMPUTING SYSTEMS (DAHPHRS) Final Report, Jun. 1989 - Sep. 1990
Charlotte O. Scheper, Robert L. Baker, and Harold L. Waters, II
Dec. 1991 231 p
(AF Proj. 2300)
(AD-A252777; RL-TR-91-397) Avail: CASI HC A11/MF A03

Systems for Space Defense Initiative (SDI) space applications typically require both high performance and very high reliability. These requirements present the systems engineer evaluating such systems with the extremely difficult problem of conducting performance and reliability trade-offs over large design spaces. A controlled development process supported by appropriate automated tools must be used to assure that the system will meet design objectives. This report will describe an investigation which examined methods, tools, and techniques necessary to

support performance and reliability modeling for SDI systems development. Models of the JPL Hypercube, the Encore Multimac, and the C.S. Draper Lab Fault-Tolerant Parallel Processor (FTPP) parallel computing architectures using candidate SDI weapons-to-target assignment algorithms as workloads were built and analyzed as a means of identifying the necessary system models, how the models interact, and what experiments and analyses should be performed. As a result of this effort, weaknesses in the existing methods and tools were revealed and capabilities that will be required for both individual tools and an integrated toolset were identified. GRA

N92-33547# Department of the Navy, Washington, DC.
I/O INTERFACE BETWEEN VME BUS AND ASYNCHRONOUS SERIAL DATA COMPUTER Patent Application
Dale W. McKim, inventor (to Navy) 4 May 1992 18 p
(AD-D015332; US-Patent-Appl-SN-880271; Navy-Case-73749)
Avail: CASI HC A03/MF A01

A computer interface is provided to support communication between a VMEbus architecture and a computer having its input/output (I/O) interface based on MIL-STD 1397B Type D or E asynchronous serial data specifications. A dual port RAM provides temporary storage for VMEbus data being transferred to the computer and computer data being transferred to the VMEbus. Both the VMEbus data and computer data are stored in a VMEbus parallel format. An interrupt controller is responsive to interrupt control signals on the VMEbus and a local bus. The interrupt controller places a processor interrupt on the local bus in response to an interrupt control signal on the VMEbus and places a VME interrupt on the VMEbus in response to an interrupt control signal on the local bus. A processor, responsive to the processor interrupt, generates a write control signal and transfers the VMEbus data stored in the dual port RAM onto the local bus. An interface controller, responsive to the write control signal and a select signal indicative of one of the type D or E I/O interface specifications, converts the VMEbus data transferred onto the local bus into asynchronous serial data in accordance with MIL-STD 1397B. The interface controller also is responsive to a request-to-send control signal from the computer to convert asynchronous serial data from the computer into computer data. The processor, also responsive to the request-to-send control signal, generates a read control signal and the interrupt control signal on the local bus. The interface controller, responsive to the read control signal, transfers the computer data to the dual port RAM via the local bus. GRA

N92-33717# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
A REVIEW OF HUMAN-HUMAN NONVERBAL COMMUNICATION: ITS POTENTIAL FOR USE IN HUMAN-COMPUTER DIALOGUE
Dina A. Fisher and Carol McCann Oct. 1991 48 p
(DCIEM-91-78; CTN-92-60582) Avail: CASI HC A03/MF A01

A review of the literature on nonverbal human-human communication is presented, categorizing nonverbal messages into five major groups: emblems, or nonverbal acts transmitting a message with a conventional verbal equivalent; illustrators, which illustrate what is being said; affect displays, which show the emotional state of an individual; regulators, used to maintain and balance a conversation; and adaptors, primarily kinetic actions that were originally part of a response to certain learning situations and are now maintained by habit. Computer based devices for sensing the various types of nonverbal input are reviewed, including input devices for the hand, foot, head movement, and body position. Examples of nonverbal protocols for human-computer interaction are presented and the feasibility of nonverbal human-computer communication is assessed for each of the five major groups of nonverbal messages. The categories of nonverbal messages that might most profitably be exploited in currently available interfaces are discussed. Author (CISTI)

N92-33897*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
IMPLEMENTATION OF AN INTELLIGENT CONTROL SYSTEM
D. L. Simon (Army Aviation Systems Command, Cleveland, OH.), E. Wong, and J. L. Musgrave May 1992 12 p Presented at the 1992 Advanced Earth-to-Orbit Propulsion Technology Conference, Huntsville, AL, 19-21 May 1992; sponsored by NASA. Marshall Space Flight Center
(NASA-TM-105795; E-7225; NAS 1.15:105795;
AVSCOM-TR-92-C-014) Avail: CASI HC A03/MF A01

A laboratory testbed facility which was constructed at NASA LeRC for the development of an Intelligent Control System (ICS) for reusable rocket engines is described. The framework of the ICS consists of a hierarchy of various control and diagnostic functions. The traditional high speed, closed-loop controller resides at the lowest level of the ICS hierarchy. Above this level resides the diagnostic functions which identify engine faults. The ICS top level consists of the coordination function which manages the interaction between an expert system and a traditional control system. The purpose of the testbed is to demonstrate the feasibility of the OCS concept by implementing the ICS as the primary controller in a simulation of the Space Shuttle Main Engine (SSME). The functions of the ICS which are implemented in the testbed are as follows: an SSME dynamic simulation with selected fault mode models, a reconfigurable controller, a neural network for sensor validation, a model-based failure detection algorithm, a rule based failure detection algorithm, a diagnostic expert system, an intelligent coordinator, and a user interface which provides a graphical representation of the event occurring within the testbed. The diverse nature of the ICS has led to the development of a distributed architecture consisting of specialized hardware and software for the implementation of the various functions. This testbed is made up of five different computer systems. These individual computers are discussed along with the schemes used to implement the various ICS components. The communication between computers and the timing and synchronization between components are also addressed. Author

N92-33925# Optical Society of America, Washington, DC.
OSA PROCEEDINGS OF THE TOPICAL MEETING ON SOFT-X-RAY PROJECTION LITHOGRAPHY, VOLUME 12 Final Report, 1 Jan. - 31 Dec. 1991
Jeffrey Bokor and Jarus W. Quinn 22 May 1992 158 p Meeting held in Monterey, CA, 10-12 Apr. 1991
(Grant AF-AFOSR-0176-91)
(AD-A252998; AFOSR-92-0156TR-Vol-12) Avail: CASI HC A08/MF A02

In the future era of 256-Mb dynamic random access memory (DRAM) chips, as minimum feature dimensions in very large scale integrated circuits shrink to 0.25 microns and below, it is widely understood that the conventional approach to projection optical lithography, using even deep ultraviolet (250-nm wavelength) radiation, will no longer be applicable. This is due to the fundamental diffraction limit, which holds that features cannot be printed with a resolution finer than that of the wavelength of the imaging radiation. Proximity x-ray lithography has received a great deal of attention as a candidate replacement for conventional optical projection lithography. In this approach, a thin membrane is used as a semi-transparent mask substrate for x rays with a wavelength of 0.8-1.2 nm, and a heavy metal absorber pattern is created on its surface. This mask is brought into close proximity (5 - 50 micron gap) to a silicon wafer coated with an x-ray sensitive photoresist and then is exposed to the x rays, thus replicating the mask pattern in the photoresist. With this method a faithful 1:1 shadow print can be obtained with resolution finer than 0.25 microns. Synchrotron storage rings as well as laser-produced plasmas are both candidates for the x-ray source. A major issue with this technique is the high cost to produce, inspect, and repair the thin membrane mask, which must have absorber features on it that are as fine as those to be produced on the wafer. Thermal distortion of the thin membrane owing to absorbed x rays is also a concern. By contrast, in today's projection optical lithography systems, a high-performance lens demagnifies a mask pattern, typically by 5x, onto the wafer. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N92-33248*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE SYNTAX OF DRAGOON: EVALUATION AND RECOMMENDATIONS
C. Michael Holloway Jul. 1992 18 p
(RTOP 505-64-10-02)
(NASA-TM-4385; L-17028; NAS 1.15:4385) Avail: CASI HC A03/MF A01

Several different ways to add linguistic support for object-oriented programming to the Ada programming language have been proposed and developed in recent years. The Distributable Reusable Ada Generated from an Object-Oriented Notation (DRAGOON) language is one such Ada extension. The DRAGOON syntax is described for classes, objects, and inheritance, and the syntax is evaluated against the following five criteria: readability, writeability, lack of ambiguity, ease of translation, and consistency with existing Ada syntax. The evaluation reveals several deficiencies in the notation. A revised syntax that corrects these deficiencies is proposed. Author

N92-33263# Stanford Univ., CA. Dept. of Computer Science.
DESIGN AND IMPLEMENTATION OF PARALLEL ALGORITHMS Final Report, Oct. 1988 - Feb. 1992
Jeffrey D. Ullman May 1992 18 p
(Contract N00014-88-K-0166)
(AD-A250894) Avail: CASI HC A03/MF A01

Greg Plaxton 1989B won the best paper award at SPAA for his recent work on three related highly fundamental problems: (1) load balancing--given a distribution of tasks to processors, move the task tokens so each processor has an equal number of tasks; (2) selection--given n items and k between 1 and n, find the kth item in sorted order; and (3) sorting--given n items distributed equally among p processors, sort the items. GRA

N92-33272# Argonne National Lab., IL.
GENOGRAPHICS FOR OPENWINDOWS (TRADEMARK)
R. Hagstrom, R. Overbeek, M. Price, D. Zawada, G. S. Michaels (National Inst. of Health, Bethesda, MD.), R. Taylor (National Inst. of Health, Bethesda, MD.), and Kaoru Yoshida (California Univ., Berkeley. Lawrence Berkeley Lab.) Apr. 1992 30 p
(Contract W-31-109-eng-38)
(DE92-017144; ANL-92/11) Avail: CASI HC A03/MF A01

GenoGraphics is a generic utility for constructing and querying one-dimensional linear plots and is the result of a request from Dr. Cassandra Smith for a tool to facilitate her genome mapping research. GenoGraphics development has benefited from a continued collaboration with her. It was written in Sun Microsystem's OpenWindows environment, and the BTOL toolkit developed at Argonne National Laboratory was used. GenoGraphics provides an interactive, intuitive, and graphical interface. Its features include: viewing multiple maps simultaneously, zooming, and querying by mouse clicking. By expediting plot generation, GenoGraphics gives the scientist more time to analyze data and a means for deducing conclusions. DOE

N92-33286# Naval Postgraduate School, Monterey, CA.
PRIVATE AND SHARED DATA IN OBJECT-ORIENTED PROGRAMMING M.S. Thesis
Vassilios Theologitis Mar. 1992 176 p
(AD-A253070) Avail: CASI HC A09/MF A02

In a typical object-oriented system, there are two kinds of variables: those which are private to instances (objects) and those which are shared by all instances of a class. Variables may also be declared in some object-oriented languages as private, public, or subtype visible which affects the access to the data. However, we know of no object-oriented programming which allows data (variables) to be declared as private for specific methods only. The purpose of this thesis is to propose a solution to the problems of implementing and maintaining both shared and private data at various levels within an object-oriented environment. GRA

N92-33392# Naval Postgraduate School, Monterey, CA. Dept. of Computer Science.
REAL-TIME SYSTEMS Summary Report
Salah M. Badr, Ronald B. Byrnes, Jr., Donald P. Brutzman, and Michael L. Nelson Feb. 1992 31 p
(AD-A252810; NPS-CS-92-004) Avail: CASI HC A03/MF A01

This paper presents an introduction to the basic issues involved in real-time systems. Both real-time operating systems and real-time programming languages are explored. Concurrent programming and process synchronization and communication are also discussed. The real-time requirements of the Naval Postgraduate School Autonomous Underwater Vehicle (AUV) are then examined. GRA

N92-33411*# Research Inst. for Computing and Information Systems, Houston, TX.
CODE INSPECTION INSTRUCTIONAL VALIDATION
Kay Orr (Southwest Research Inst., San Antonio, TX.) and Shirley Stancil (Southwest Research Inst., San Antonio, TX.) 30 Jul. 1992 152 p
(Contract NCC9-16; RICIS Proj. ET-31)
(NASA-CR-190718; NAS 1.26:190718) Avail: CASI HC A08/MF A02

The Shuttle Data Systems Branch (SDSB) of the Flight Data Systems Division (FDSD) at Johnson Space Center contracted with Southwest Research Institute (SwRI) to validate the effectiveness of an interactive video course on the code inspection process. The purpose of this project was to determine if this course could be effective for teaching NASA analysts the process of code inspection. In addition, NASA was interested in the effectiveness of this unique type of instruction (Digital Video Interactive), for providing training on software processes. This study found the Carnegie Mellon course, 'A Cure for the Common Code', effective for teaching the process of code inspection. In addition, analysts prefer learning with this method of instruction, or this method in combination with other methods. As is, the course is definitely better than no course at all; however, findings indicate changes are needed. Following are conclusions of this study. (1) The course is instructionally effective. (2) The simulation has a positive effect on student's confidence in his ability to apply new knowledge. (3) Analysts like the course and prefer this method of training, or this method in combination with current methods of training in code inspection, over the way training is currently being conducted. (4) Analysts responded favorably to information presented through scenarios incorporating full motion video. (5) Some course content needs to be changed. (6) Some content needs to be added to the course. SwRI believes this study indicates interactive video instruction combined with simulation is effective for teaching software processes. Based on the conclusions of this study, SwRI has outlined seven options for NASA to consider. SwRI recommends the option which involves creation of new source code and data files, but uses much of the existing content and design from the current course. Although this option involves a significant software development effort, SwRI believes this option will produce the most effective results. Author

N92-33504# Honeywell, Inc., Minneapolis, MN. Systems and Research Center.
HONEYWELL PROTOTECH, PHASE 1 Final Report, Dec. 1989 - Jun. 1992
John Kimball, Tim King, Aaron Larson, Chris Miller, and Jon Ward Jun. 1992 47 p
(Contract N00014-90-C-0015)
(AD-A252921; CS-C92-002-Phase-1) Avail: CASI HC A03/MF A01

This report describes the Environment for Software Prototyping (ESP). Within ESP, prototyping is viewed as an experimental process whose results drive the evolution of a domain theory in

the context of a megaprogramming environment. ESP is used to evaluate the nature and efficiency of technologies that address requirements unique to prototyping. ESP consists of a component shelf containing reusable components (i.e., a component consists of a specification and a set of implementations), a repository for reusable software architectures (i.e., an architecture defines the structural characteristics of a system), and a workbench (i.e., a workspace for conducting prototyping experiments). ESP provides an environment for bootstrapping a megaprogramming capability. GRA

N92-33533*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AUTOMATIC DIFFERENTIATION AS A TOOL IN ENGINEERING DESIGN
Jean-Francois Barthelemy and Laura E. Hall (Unisys Corp., Hampton, VA.) Aug. 1992 11 p Proposed for presentation at the Fourth AIAA/Air Force/NASA/OAI Symposium on Multidisciplinary Analysis and Optimization, Cleveland, OH, 21-23 Sep. 1992
(RTOP 505-63-50-06)
(NASA-TM-107661; NAS 1.15:107661) Avail: CASI HC A03/MF A01

Automatic Differentiation (AD) is a tool that systematically implements the chain rule of differentiation to obtain the derivatives of functions calculated by computer programs. AD is assessed as a tool for engineering design. The forward and reverse modes of AD, their computing requirements, as well as approaches to implementing AD are discussed. The application of two different tools to two medium-size structural analysis problems to generate sensitivity information typically necessary in an optimization or design situation is also discussed. The observation is made that AD is to be preferred to finite differencing in most cases, as long as sufficient computer storage is available; in some instances, AD may be the alternative to consider in lieu of analytical sensitivity analysis. Author

N92-33539# Naval Postgraduate School, Monterey, CA. Dept. of Computer Science.
SYSTEMATIC DEVELOPMENT OF HARD REAL-TIME SOFTWARE: A COMPARATIVE STUDY OF THREE METHODS
Yuh-Jeng Lee and Valdis Berzins Apr. 1992 32 p
(AD-A252784; NPS-CS-92-007) Avail: CASI HC A03/MF A01

We present a comparative study on three software development methods which cover the entire development life cycle for hard real-time systems: (1) Structured Analysis, (2) Computer Aided Prototyping, and (3) Spec formal logic specification method. We use a simple example to demonstrate the software development process using all three approaches. The strengths and weaknesses of each method are discussed. GRA

N92-33565# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
USING THE ISIS RESOURCE MANAGER FOR DISTRIBUTED, FAULT-TOLERANT COMPUTING
Timothy Clark and Kenneth Birman Jun. 1992 15 p
(AD-A252953; TR-92-1289) Avail: CASI HC A03/MF A01

Under current versions of the UNIX operating system, it is difficult to take advantage of the massive computing power of idle or lightly-loaded workstations on a network. This paper introduces the ISIS Resource Manager, a distributed, fault-tolerant application capable of recapturing this processing power, as well as providing a transparent interface to network computing resources. GRA

N92-33569*# Research Inst. for Computing and Information Systems, Houston, TX.
GROUND SYSTEMS DEVELOPMENT ENVIRONMENT (GSDE) INTERFACE REQUIREMENTS AND PROTOTYPING PLAN
Victor E. Church (Computer Sciences Corp., Beltsville, MD.), John Philips (Computer Sciences Corp., Beltsville, MD.), Mitchell Bassman (Computer Sciences Corp., Beltsville, MD.), and C. Williams (Computer Sciences Corp., Beltsville, MD.) Apr. 1991 68 p
(Contract NCC9-16; RICIS Proj. SE-34)
(NASA-CR-190715; NAS 1.26:190715; CSC/TR-90/6155) Avail: CASI HC A04/MF A01

The data collection and requirements analysis effort of the Ground Systems Development Environment (GSDE) Interface Requirements study are described. Potential problems in the interfaces among applications and processors in the heterogeneous systems that comprise the GSDE are identified. Possible strategies for addressing those problems are described. Areas where further research and prototyping are needed to demonstrate the capabilities and feasibility of those strategies are identified, and a plan for building the necessary software prototypes. Author

N92-33607*# Research Inst. for Computing and Information Systems, Houston, TX.
SSE SOFTWARE TEST MANAGEMENT STM CAPABILITY: USING STM IN THE GROUND SYSTEMS DEVELOPMENT ENVIRONMENT (GSDE)
Victor E. Church (Computer Sciences Corp., Beltsville, MD.), D. Long (Computer Sciences Corp., Beltsville, MD.), Ray Hartenstein (Computer Sciences Corp., Beltsville, MD.), and Alfredo Perez-Davila (Houston Univ., Clear Lake, TX.) Feb. 1992 22 p
(Contract NCC9-16; RICIS Proj. SE-34)
(NASA-CR-190717; NAS 1.26:190717) Avail: CASI HC A03/MF A01

This report is one of a series discussing configuration management (CM) topics for Space Station ground systems software development. It provides a description of the Software Support Environment (SSE)-developed Software Test Management (STM) capability, and discusses the possible use of this capability for management of developed software during testing performed on target platforms. This is intended to supplement the formal documentation of STM provided by the SEE Project. How STM can be used to integrate contractor CM and formal CM for software before delivery to operations is described. STM provides a level of control that is flexible enough to support integration and debugging, but sufficiently rigorous to insure the integrity of the testing process. Author

N92-33653# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.
COMPARISON OF THE COSTS OF ALGEBRAIC CODING PROCESSES FOR A FLEXIBLE ERROR CORRECTING CHANNEL CODEC Ph.D. Thesis [VERGLEICH DES AUFWANDES VON ALGEBRAISCHEN CODIERVERFAHREN FUER EINEN FLEXIBLEN, FEHLERKORRIGIERENDEN KANALCODEC]
Martin Hahn 1991 137 p In GERMAN
(ETN-92-92131) Avail: CASI HC A07/MF A02

The presented system concept was developed with regard to remote transmission applications for videoconference data. A detailed comparison of the various algebraic coding processes was given with respect to their costs. The Codec system concept was the lowest cost process. The comparison of the realization costs was carried out with nine different algebraic coding processes for Reed Solomon Codes (RSC), and six algebraic processes for binary Bose Chaudhuri Hocquenghem (BCH) codes. The conversion of the process of mixed coding for both code classes in the flexible system concept for a channel codec was emphasized. ESA

N92-33685# Universiteit Twente, Enschede (Netherlands). Dept. of Computer Science.
ALGEBRAIC SPECIFICATION OF A LINE EDITOR [ALGEBRAISCHE SPECIFIKATIE VAN EEN LINE-EDITOR]
Jan Kuper and Paul Oude Luttighuis 18 Oct. 1991 24 p In DUTCH
(Memo-INF-91-75; ETN-92-91769) Copyright Avail: CASI HC A03/MF A01

An algebraic specification of a line editor is given as a first introduction to the technique of algebraic specifications. The

specification of the natural numbers is outlined. The specification of the line editor was implemented. The correctness of the implementation was proven. ESA

N92-33805# Technische Univ., Berlin (Germany, F.R.). Fachbereich Informatik.
EFFICIENT SOLUTION OF CONFIGURATION TASKS Ph.D. Thesis [EFFIZIENTES LOESEN VON KONFIGURIERUNGSAUFGABEN]
Manfred Hein 1991 213 p In GERMAN
(ETN-92-92135) Avail: CASI HC A10/MF A03

A precise definition of configuration tasks is given. A formal model gives criteria in order to delimit configuration tasks from parameterization and arrangement tasks. For design problem solving, the definition of configuration tasks leads to a detailed structure. The description of related tasks gives indication on further diversification of design problems. The solution idea results from the fact that a model of all possible variants is available. The program describes all variants which are suitable for the customers. ESA

N92-33823# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MANTRA: A SHELL FOR HYBRID KNOWLEDGE REPRESENTATION
J. Calmet (Institute of Algorithms and Cognitive Systems, Karlsruhe, Germany, F.R), I. A. Tjandra (Institute of Algorithms and Cognitive Systems, Karlsruhe, Germany, F.R), and Guilherme Bittencourt Dec. 1991 12 p Presented at the 3rd International Conference on Tools for Artificial Intelligence, San Jose, CA, 10-13 Nov. 1991
(INPE-5334-PRE/1733) Avail: CASI HC A03/MF A01

We present a shell for hybrid knowledge representation. This system supports four different knowledge representation formalisms: first-order logic, terminological language, semantic networks, and production systems. The system automatically supports hybrid inferences taking into account the knowledge represented in different formalisms. All the algorithms involved in the inferences, supported by the system, are decidable, and have the property of being sound and complete according to a four-valued semantics. Besides these facilities, the shell allows the user to represent procedural knowledge of a domain using the primitives embedded at the heuristic level. The system was implemented in Common Lisp, and makes use of an object-oriented extension for this language. Author

N92-33892# EG and G Energy Measurements, Inc., Idaho Falls.
MODELING THE CRAY MEMORY SCHEDULER
K. L. Wickham and G. L. Litteer Apr. 1992 7 p
(Contract DE-AC07-76ID-01570)
(DE92-018056; EGG-CODP-10201) Avail: CASI HC A02/MF A01

This report documents the results of a project to evaluate low cost modeling and simulation tools when applied to modeling the Cray memory scheduler. The specific tool used is described and the basics of the memory scheduler are covered. Results of simulations using the model are discussed and a favorable recommendation is made to make more use of this inexpensive technology. DOE

N92-33894*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
A GRAPHICAL USER-INTERFACE FOR PROPULSION SYSTEM ANALYSIS
Brian P. Curlett and Kathleen Ryall (Harvard Univ., Cambridge, MA.) Aug. 1992 28 p
(RTOP 505-69-50)
(NASA-TM-105696; E-7158; NAS 1.15:105696) Avail: CASI HC A03/MF A01

NASA LeRC uses a series of computer codes to calculate installed propulsion system performance and weight. The need to evaluate more advanced engine concepts with a greater degree of accuracy has resulted in an increase in complexity of this analysis system. Therefore, a graphical user interface was developed to allow the analyst to more quickly and easily apply these codes. The development of this interface and the rationale for the approach taken are described. The interface consists of a method of pictorially representing and editing the propulsion system configuration, forms for entering numerical data, on-line help and documentation, post processing of data, and a menu system to control execution. Author

N92-33905 National Physical Lab., Teddington (England). Information Technology and Computing Div.
AUTOMATIC TRANSLATION OF VDM SPECIFICATIONS INTO STANDARD ML PROGRAMS
G. ONeill Feb. 1992 48 p
(NPL-DITC-196/92; ETN-92-91985) Copyright Avail: National Physical Lab., Teddington, Middlesex, TW11 0LW, England

Interim Defence Standard 00-55 contains requirements and guidance in the selection of a formal method for producing formal specifications, and in the verification and validation of such specifications. The use of a syntax directed editor, designed as an entry tool for VDM specifications, to produce executable prototypes by the automatic translation of VDM specifications into standard ML programs, is shown. Several executable examples of this translation process are given. The above approach is also shown to meet many of the requirements in 00-55 for the production, verification and validation of formal specifications. The specification requirements of other, less demanding, standards for high quality or safety critical software will also be largely met by this approach. ESA

N92-33913# Oxford Univ. (England). Robotics Research Group.
TOWARDS A UNIFIED METHODOLOGY FOR THE DESIGN AND DEVELOPMENT OF DISTRIBUTED CONTROL SYSTEM SOFTWARE
Y. K. H. Lau 1991 195 p
(OUEL-1904/91; ETN-92-92060) Avail: CASI HC A09/MF A03

A unified approach to the design and development of distributed control software is presented. This method is a result of a 'tight' integration between a formal method for concurrent systems (CSP) and a structured method for distributed control system (DARTS). The various exisiting formal specification and verification techniques and their related applications to step development are reviewed. The conventional structured techniques that are widely used by the engineering community are reported. The salient properties of a typical control system are identified and the specification partial verification and full documentation of the formal building blocks for the full specification of such systems, are presented. The majority of the software development at a high level of a direct drive robot system is described. Implementation of formally specified systems such as the Zeroth and First level models of the robot control system developed are addressed. In particular, the design and development of a proof assistant is discussed: the Causality Diagram Evaluation Tool (CDET), which is used for prototyping CSP processes. The results are summarized and conclusions on the advantages and limitations concerning the unification of the two methods is evaluated. Through this, the applicability of formal methods to control software development is evaluated. Comments on possible future research directions are made. ESA

N92-33940*# Research Inst. for Computing and Information Systems, Houston, TX.
PROGRAMMING IN A PROPOSED 9X DISTRIBUTED Ada Interim Report No. 2
Raymond S. Waldrop (Texas A&M Univ., College Station.), Richard A. Volz (Texas A&M Univ., College Station.), Stephen J. Goldsack (Imperial Coll. of Science and Technology, London, England), and A. A. Holzbach-Valero (Imperial Coll. of Science and Technology, London, England) May 1991 35 p
(Contract NCC9-16; RICIS Proj. SE-35)
(NASA-CR-190634; NAS 1.26:190634) Avail: CASI HC A03/MF A01

The studies of the proposed Ada 9X constructs for distribution,

now referred to as AdaPT are reported. The goals for this time period were to revise the chosen example scenario and to begin studying about how the proposed constructs might be implemented. The example scenario chosen is the Submarine Combat Information Center (CIC) developed by IBM for the Navy. The specification provided by IBM was preliminary and had several deficiencies. To address these problems, some changes to the scenario specification were made. Some of the more important changes include: (1) addition of a system database management function; (2) addition of a fourth processing unit to the standard resources; (3) addition of an operator console interface function; and (4) removal of the time synchronization function. To implement the CIC scenario in AdaPT, the decided strategy were publics, partitions, and nodes. The principle purpose for implementing the CIC scenario was to demonstrate how the AdaPT constructs interact with the program structure. While considering ways that the AdaPt constructs might be translated to Ada 83, it was observed that the partition construct could reasonably be modeled as an abstract data type. Although this gives a useful method of modeling partitions, it does not at all address the configuration aspects on the node construct. I.I.C.

N92-33992# Grenoble-1 Univ. (France). Lab. ARTEMIS.
DYNAMIC PROGRAMMING AND THE GRAPHICAL TRAVELING SALESMAN PROBLEM
Jean Fonlupt and Armand Nachef (Angers Univ., France) Apr. 1991 33 p
(IMAG-RR-851-I; ETN-92-92069) Avail: CASI HC A03/MF A01

Cases of polynomial resolution of the traveling salesman problem are studied. A generalization of the traveling salesman problem, where the cost of an edge depends on the number of times this edge is visited in a tour, is defined; here an edge may be visited 0, 1 or 2 times. By this generalization, polynomial algorithms to solve the traveling salesman problem on certain classes of graphs which are built from basic graphs by operations called r-sum, with r fixed, can be found. The underlying ideas of these algorithms are similar to dynamic programming techniques. The classes contain most of the known instances for which the graphical and classical salesman problems are polynomial. ESA

N92-33993# Grenoble-1 Univ. (France). Lab. de Modelisation et Calcul.
BINARY MIXING: GEOMETRIC MODELS AND ALGORITHMS [LES MELANGES BINAIRES: MODELISATION GEOMETRIQUE ET ALGORITHMES]
B. Lacolle, N. Szafran, and P. Valentin (Elf-France, Saint Symphorien d'Ozon.) Feb. 1991 30 p In FRENCH
(IMAG-RR-841-M; ETN-92-92073) Avail: CASI HC A03/MF A01

Computational methods in a particular case of mixing and separation theory, aimed at the production of some given products by mixing parts of basic mixtures, are presented. In the geometrical approach used, mixtures are represented by vectors and mixing process by vectors sum, in the vector space of physicochemical species which characterize the mixtures. The feasibility of a mixture is viewed as a point inclusion in the convex set of mixtures which is a zonotope associated with basic mixtures. The geometric approach yields to simple formulations for the optimal fabrication of a mixture, as well as the fabrication of a sequence of mixtures. Binary mixtures characterized by two species only are addressed. The geometrical approach of binary mixtures management yields to plane geometry problems. Optimal algorithms for solving the main problems of binary mixtures, with the mainframe of computational geometry, are presented. In order to set up computational methods, a presentation of some properties previously known is given in more general and more abstract context. ESA

N92-33997# European Space Agency, Paris (France). Board for Software Standardization and Control.
GUIDE TO THE SOFTWARE ENGINEERING STANDARDS
Oct. 1991 10 p
(ESA-PSS-05-01-Issue-1; ETN-92-91966) Copyright Avail: CASI HC A02/MF A01

ESA PSS-05-0 describes the software engineering standards to be applied to all deliverable software implemented for the European Space Agency, either in house or by industry. ESA PSS-05-0 is the top level software engineering standard and is the root of a document tree. Lower level standards that branch from this root contain advisory and optional material. This document defines and explains the principles and conventions of the document tree. ESA

N92-34005# Universiteit Twente, Enschede (Netherlands). Tele-Informatics and Open Systems Group.
SPECIFICATION OF A DISTRIBUTED COORDINATION FUNCTION IN LOTOS
Ing Widya, Franck Sadoun (Syseca Logiciel, Saint Cloud, France), and Gert-Jan vanderHeijden (Oce Nederland B.V., Venlo.) Sep. 1991 20 p Sponsored by Commission of the European Communities
(Memo-INF-91-72; TIOS-91/027; ETN-92-91573) Copyright Avail: CASI HC A03/MF A01

The application of a design method in the specification of a realistic OSI (Open Systems Interconnection) protocol in LOTOS (Language Of Temporal Ordering Specification) is presented. Some experiences acquired during this specification are reported. The protocol selected is a subset of the ISO (International Standards Organization) Transaction Processing Protocol. The specification rationale of the protocol, and in particular, that of the Multiple Association Coordination Function is emphasized. This function is suitable for a design exercise due to its responsibility to coordinate distributedly the interworking of the encapsulating protocol entity with the other entities which are involved in a transaction. The design process starts with a nonformalized protocol description and yields a specification which incorporates some implementation aspects. This will enable further elaboration of the specification towards an implementation. The work was accomplished within a project that aimed at the development of a LOTOS based design method to satisfy industrial needs. In this perspective, this work may be regarded as an industrial assessment of that part of the design method which concerns the formal specification of a nonformalized description. ESA

N92-34007# Universiteit Twente, Enschede (Netherlands). Tele-Informatics and Open Systems Group.
PROTOCOL DESIGN USING LOTOS: A CRITICAL SYNTHESIS OF A STANDARDIZATION EXPERIENCE
H. Kremer, J. v.d.Lagemaat, A. Rennoch (Gesellschaft fuer Mathematik und Datenverarbeitung, Berlin, Germany, F.R.), and G. Scollo Jan. 1992 25 p
(Memo-INF-92-07; TIOS-92/05; ETN-92-91781) Copyright Avail: CASI HC A03/MF A01

A critical synthesis of experience in the specification in LOTOS of the International Standards Organization transport protocol and service standards is presented, based on the quality design criteria developed in the Lotosphere design methodology. The results show the suitability of LOTOS for the specification of large communication protocols. Such specification serves as an excellent starting point for product development as well as for the rigorous validation of the standards. A list of problems discovered, as well as suggestions to alleviate them and directions for further research are included. ESA

N92-34009# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Information.
COUPLING APPLICATION DESIGN AND USER INTERFACE DESIGN
Dennis J. M. J. deBaar, James D. Foley (Georgia Inst. of Tech., Atlanta.), Kevin E. Mullet (SunSoft, Inc., Mountain View, CA.), and Charles A. vanderMast 1992 13 p Sponsored in part by Sun Microsystems, Inc.
(Grant NSF IRI-88-13179)
(Rept-92-03; ETN-92-91855) Copyright Avail: CASI HC A03/MF A01

Building an interactive application involves the design of both a data model and a Graphical User Interface (GUI) to represent that model to the user. These two design activities are typically approached as separate tasks and are frequently undertaken by different individuals or groups. The approach outlined eliminates redundant specification work by generating an interface directly from the data model itself. An inference engine using style rules for selecting and placing GUI controls (widgets) is integrated with an interface design tool to generate a user interface definition. This approach allows a single data model to be mapped onto multiple GUI's by substituting the appropriate rule set and thus, represents a first step toward a GUI independent run time layout facility. ESA

N92-34090# Sandia National Labs., Albuquerque, NM.
HIGH-PERFORMANCE SCIENTIFIC COMPUTING USING C++
K. G. Budge, J. S. Peery, and A. C. Robinson 1992 20 p Presented at the USENIX Technical Conference, Portland, OR, 10-14 Aug. 1992
(Contract DE-AC04-76DP-00789)
(DE92-017046; SAND-92-0605C; CONF-9208105-1) Avail: CASI HC A03/MF A01

Concepts from mathematics and physics often map well to object-oriented software since the original concepts are of an abstract nature. We describe our experiences with developing high-performance shock-wave physics simulation codes in C++ and discuss the software engineering issues which we have encountered. The primary enabling technology in C++ for allowing us to share software between our development groups is operator overloading for a number of 'numeric' objects. Unfortunately, this enabling feature also impacts the efficiency of our computations. We describe the techniques we have utilized for minimizing this difficulty. DOE

N92-34110*# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
OPTIMAL PRIMARY-BACKUP PROTOCOLS
Navin Budhiraja, Keith Marzullo, Fred B. Schneider, and Sam Toueg Aug. 1992 19 p
(Contract NAG2-593; N00014-91-J-1219; NSF CCR-87-01103; NSF CCR-90-14363; NSF CCR-89-01780; NSF CCR-91-02231)
(NASA-CR-190673; NAS 1.26:190673; TR-92-1299) Avail: CASI HC A03/MF A01

We give primary-backup protocols for various models of failure. These protocols are optimal with respect to degree of replication, failover time, and response time to client requests. Author

N92-34125# Rome Univ. (Italy).
NUMERICAL OPTIMIZATION Final Technical Report
Francesco Zirilli 1992 72 p
(Contract DAJA45-85-C-0028)
(AD-A253433; R/D-5265-MA-01) Avail: CASI HC A04/MF A01

In the framework of the proposed continuous approach to constrained optimization problems, we describe two new solution methods which resulted from the research. The first is a continuous inexact method for solving systems of nonlinear equations and complementarity problems (along the lines of the DAFNE method), and the second is a continuous method for solving the linear programming problems (along the lines of Karmarkar's method) which is shown to be quadratically convergent. Some numerical experience on a number of test problems is reported. GRA

N92-34149*# Research Inst. for Computing and Information Systems, Houston, TX.
FUZZY SETS, ROUGH SETS, AND MODELING EVIDENCE: THEORY AND APPLICATION. A DEMPSTER-SHAFER BASED APPROACH TO COMPROMISE DECISION MAKING WITH MULTIATTRIBUTES APPLIED TO PRODUCT SELECTION
Andre deKorvin (Houston Univ., TX.) Jul. 1992 31 p
(Contract NCC9-16; RICIS Proj. SR-01)
(NASA-CR-190709; NAS 1.26:190709) Avail: CASI HC A03/MF A01

The Dempster-Shafer theory of evidence is applied to a multiattribute decision making problem whereby the decision maker (DM) must compromise with available alternatives, none of which exactly satisfies his ideal. The decision mechanism is constrained by the uncertainty inherent in the determination of the relative importance of each attribute element and the classification of existing alternatives. The classification of alternatives is addressed through expert evaluation of the degree to which each element is contained in each available alternative. The relative importance of each attribute element is determined through pairwise comparisons of the elements by the decision maker and implementation of a ratio scale quantification method. Then the 'belief' and 'plausibility' that an alternative will satisfy the decision maker's ideal are calculated and combined to rank order the available alternatives. Application to the problem of selecting computer software is given. Author

N92-34176*# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
THE PROCESS GROUP APPROACH TO RELIABLE DISTRIBUTED COMPUTING Technical Report, Jul. 1991
Kenneth P. Birman 26 Sep. 1992 37 p Revised Sponsored in part by DARPA, IBM, HP, Siemens, GTE and Hitachi
(Grant NAG2-593)
(NASA-CR-190914; NAS 1.26:190914; TR-91-1216) Avail: CASI HC A03/MF A01

The difficulty of developing reliable distribution software is an impediment to applying distributed computing technology in many settings. Experience with the ISIS system suggests that a structured approach based on virtually synchronous process groups yields systems that are substantially easier to develop, exploit sophisticated forms of cooperative computation, and achieve high reliability. Six years of research on ISIS, describing the model, its implementation challenges, and the types of applications to which ISIS has been applied are reviewed. Author

N92-34181# Navy Personnel Research and Development Center, San Diego, CA.
INTERACTIVE COURSEWARE STANDARDS Final Report, Sep. 1990 - Apr. 1991
Kent Newbury, Tom Bridges, and Walter F. Thode Jul. 1992 33 p
(AD-A253368; NPRDC-TN-92-17) Avail: CASI HC A03/MF A01

The Navy is in the process of developing interactive courseware (ICW) standards that can be used by the Navy training community to develop ICW. This report surveys existing applicable government and industry standards and emerging technologies and describes how they related to Navy ICW development. Information is provided on existing DoD and Navy standards, operating systems, programming languages, multimedia peripheral interfaces, integrated multimedia, graphic display software, windowing software, optical disc technology, data storage and compression, and document processing. Recommendations are provided for the Navy's ICW community and for those who set the Navy's policies on ICW. GRA

N92-34196*# Research Inst. for Computing and Information Systems, Houston, TX.
TRANSFORMING AdaPT TO Ada Interim Status Report No. 3
Stephen J. Goldsack (Imperial Coll. of Science and Technology, London, England), A. A. Holzbach-Valero (Imperial Coll. of Science and Technology, London, England), Raymond S. Waldrop (Texas A&M Univ., College Station.), and Richard A. Volz (Texas A&M Univ., College Station.) 27 Apr. 1991 29 p
(Contract NCC9-16; RICIS Proj. SE-35)
(NASA-CR-190635; NAS 1.26:190635) Avail: CASI HC A03/MF A01

This paper describes how the main features of the proposed Ada language extensions intended to support distribution, and offered as possible solutions for Ada9X can be implemented by transformation into standard Ada83. We start by summarizing the features proposed in a paper (Gargaro et al, 1990) which constitutes the definition of the extensions. For convenience we have called

the language in its modified form AdaPT which might be interpreted as Ada with partitions. These features were carefully chosen to provide support for the construction of executable modules for execution in nodes of a network of loosely coupled computers, but flexibly configurable for different network architectures and for recovery following failure, or adapting to mode changes. The intention in their design was to provide extensions which would not impact adversely on the normal use of Ada, and would fit well in style and feel with the existing standard. We begin by summarizing the features introduced in AdaPT. Author

N92-34197*# Research Inst. for Computing and Information Systems, Houston, TX.
GROUND SYSTEMS DEVELOPMENT ENVIRONMENT (GSDE) INTERFACE REQUIREMENTS ANALYSIS: OPERATIONS SCENARIOS Interim Report
Victor E. Church (Computer Sciences Corp., Beltsville, MD.) and John Phillips (Computer Sciences Corp., Beltsville, MD.) Feb. 1991 75 p
(Contract NCC9-16; RICIS Proj. SE-34)
(NASA-CR-190714; NAS 1.26:190714; CSC/TM-91/6061) Avail: CASI HC A04/MF A01

This report is a preliminary assessment of the functional and data interface requirements to the link between the GSDE GS/SPF (Amdahl) and the Space Station Control Center (SSCC) and Space Station Training Facility (SSTF) Integration, Verification, and Test Environments (IVTE's). These interfaces will be involved in ground software development of both the control center and the simulation and training systems. Our understanding of the configuration management (CM) interface and the expected functional characteristics of the Amdahl-IVTE interface is described. A set of assumptions and questions that need to be considered and resolved in order to complete the interface functional and data requirements definitions are presented. A listing of information items defined to describe software configuration items in the GSDE CM system is included. It also includes listings of standard reports of CM information and of CM-related tools in the GSDE. Author

N92-34215*# New Mexico State Univ., Las Cruces. Dept. of Mechanical Engineering.
AN ADAPTIVE GRID ALGORITHM FOR ONE-DIMENSIONAL NONLINEAR EQUATIONS Final Report
William E. Gutierrez and Richard G. Hills Aug. 1990 129 p
(Grant NAG2-474)
(NASA-CR-190890; NAS 1.26:190890) Avail: CASI HC A07/MF A02

Richards' equation, which models the flow of liquid through unsaturated porous media, is highly nonlinear and difficult to solve. Step gradients in the field variables require the use of fine grids and small time step sizes. The numerical instabilities caused by the nonlinearities often require the use of iterative methods such as Picard or Newton interation. These difficulties result in large CPU requirements in solving Richards equation. With this in mind, adaptive and multigrid methods are investigated for use with nonlinear equations such as Richards' equation. Attention is focused on one-dimensional transient problems. To investigate the use of multigrid and adaptive grid methods, a series of problems are studied. First, a multigrid program is developed and used to solve an ordinary differential equation, demonstrating the efficiency with which low and high frequency errors are smoothed out. The multigrid algorithm and an adaptive grid algorithm is used to solve one-dimensional transient partial differential equations, such as the diffusive and convective-diffusion equations. The performance of these programs are compared to that of the Gauss-Seidel and tridiagonal methods. The adaptive and multigrid schemes outperformed the Gauss-Seidel algorithm, but were not as fast as the tridiagonal method. The adaptive grid scheme solved the problems slightly faster than the multigrid method. To solve nonlinear problems, Picard iterations are introduced into the adaptive grid and tridiagonal methods. Burgers' equation is used as a test problem for the two algorithms. Both methods obtain solutions of comparable accuracy for similar time increments. For the Burgers' equation, the adaptive grid method finds the solution approximately three times faster than the tridiagonal method. Finally, both schemes are used to solve the water content formulation of the Richards' equation. For this problem, the adaptive grid method obtains a more accurate solution in fewer work units and less computation time than required by the tridiagonal method. The performance of the adaptive grid method tends to degrade as the solution process proceeds in time, but still remains faster than the tridiagonal scheme. Author

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N92-33261# Naval Postgraduate School, Monterey, CA.
IMPLEMENTATION OF FUZZY INFERENCE SYSTEMS USING NEURAL NETWORK TECHNIQUES M.S. Thesis
Billy E. Hudgins, Jr. Mar. 1992 46 p
(AD-A252929) Avail: CASI HC A03/MF A01

Fuzzy inference systems work well in many control applications. One drawback, however, is determining membership functions and inference control rules required to implement the system, which are usually supplied by 'experts'. One alternative is to use a neural network-type architecture to implement the fuzzy inference system, and neural network-type training techniques to 'learn' the control parameters needed by the fuzzy inference system. By using a generalized version of a neural network, the rules of the fuzzy inference system can be learned without the assistance of experts. GRA

N92-33399# Mitre Corp., Bedford, MA.
INTRODUCTION TO PARALLEL COMPUTING
E. L. Lafferty, M. C. Michaud, M. J. Prelle, and J. B. Goethert May 1992 141 p
(AD-A252923; MTR-92B0000103) Avail: CASI HC A07/MF A02

Today's supercomputers and parallel computers provide an unprecedented amount of computational power in one machine. A basic understanding of the parallel computing techniques that assist in the capture and utilization of that computational power is essential to appreciate the capabilities and the limitations of parallel supercomputers. In addition, an understanding of technical vocabulary is critical in order to converse about parallel computers. The relevant techniques, vocabulary, currently available hardware architectures, and programming languages which provide the basic concepts of parallel computing are introduced in this document. This document updates the document entitled Introduction to Parallel Supercomputing, M88-42, October 1988. It includes a new section on languages for parallel computers, updates the hardware related sections, and includes current references. GRA

N92-33409 Montreal Univ. (Quebec).
ALGORITHMS AND ARCHITECTURES FOR PARALLEL COMPUTERS IN MICROELECTRONICS Ph.D. Thesis [ALGORITHMES ET ARCHITECTURES POUR ORDINATEURS PARALLELES EN MICROELECTRONIQUE]
Daniel Audet Jun. 1989 244 p In FRENCH
(ISBN-0-315-58208-1; CTN-92-60566) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

A novel approach to the design of integrated parallel systems is developed, called the dynamic concatenation approach (DCA). It is proposed to group small processing elements to build processors of various storage capacities and processing power within a fixed size structure. The DCA establishes the requirements of the algorithms to be executed and configures the system accordingly. Several models are developed in order to describe the effects of different phenomena involved in the execution of a class of parallel algorithms. The effect of register allocation on the execution time is first analyzed, and an expression is derived which allows a considerable simplification of the effect of register allocation. A methodology is defined to measure the effect on the

execution time of the internal parallelism achievable within a processor architecture. Finally, a model allowing the selection of the most appropriate processor configuration is derived, combining the two previous models. Case studies and general analyses are performed to estimate the performance speedups available. It is shown that the average speedup i s substantial with respect to a system with fixed architecture. The elements necessary to implement systems using DCA technologies are given. It is shown that the performance gains from DCA are much greater than its costs. Author (CISTI)

N92-33528# California Univ., Los Angeles. Dept. of Computer Science.
PARALLEL SYSTEMS LABORATORY: ACCESS, ALLOCATION, AND CONTROL Final Technical Report, 1 Jul. 1987 - 30 Jun. 1992
Leonard Kleinrock 30 Jun. 1992 57 p
(Contract MDA903-87-C-0663; DARPA Order 2496)
(AD-A252251) Avail: CASI HC A04/MF A01

The included papers summarize a number of our research activities, but are only a sample of our work. The brief statement of work which describes the tasks on which we have been working during this contract are as follows: (1) Fundamental Tools and Issues in Parallel Processing Systems; (2) Parallel Processing Architecture and Algorithm Design; (3) Migrating and Adaptive Processes; (4) Distributed Data Base; (5) Tightly Coupled Parallel Processing Systems; and (6) Experimentation in Parallel Systems. GRA

N92-33566# Army Armament Research, Development and Engineering Center, Watervliet, NY.
ADAPTIVE METHODS AND PARALLEL COMPUTATION FOR PARTIAL DIFFERENTIAL EQUATIONS Final Report
Rupak Biswas, Messaoud Benantar, and Joseph E. Flaherty May 1992 28 p
(AD-A252955; ARCCB-TR-92021) Avail: CASI HC A03/MF A01

The adaptive solution of two-dimensional vector systems of hyperbolic and elliptic partial differential equations on shared-memory parallel computers are considered. Hyperbolic systems are approximated by an explicit finite volume technique and solved by a recursive local mesh refinement procedure on a tree-structured grid. Local refinement of the time steps and spatial cells of a coarse base mesh is performed in regions where a refinement indicator exceeds a prescribed tolerance. Computational procedures that sequentially traverse the tree while processing solutions on each grid in parallel, that process solutions at the same tree level in parallel, and that dynamically assign processors to nodes of the tree have been developed and applied to an example. Computational results comparing a variety of heuristic processor load balancing techniques and refinement strategies are presented. GRA

N92-33568*# Research Inst. for Computing and Information Systems, Houston, TX.
THE MULTIDRIVER: A RELIABLE MULTICAST SERVICE USING THE XPRESS TRANSFER PROTOCOL Interim Report
Bert J. Dempsey (Digital Technology, Inc., Champaign, IL.), John C. Fenton (Digital Technology, Inc., Champaign, IL.), and Alfred C. Weaver (Digital Technology, Inc., Champaign, IL.) Aug. 1990 24 p
(Contract NCC9-16; RICIS Proj. SE-31)
(NASA-CR-190631; NAS 1.26:190631) Avail: CASI HC A03/MF A01

A reliable multicast facility extends traditional point-to-point virtual circuit reliability to one-to-many communication. Such services can provide more efficient use of network resources, a powerful distributed name binding capability, and reduced latency in multidestination message delivery. These benefits will be especially valuable in real-time environments where reliable multicast can enable new applications and increase the availability and the reliability of data and services. We present a unique multicast service that exploits features in the next-generation, real-time transfer layer protocol, the Xpress Transfer Protocol (XTP). In its reliable mode, the service offers error, flow, and rate-controlled multidestination delivery of arbitrary-sized messages, with provision for the coordination of reliable reverse channels. Performance measurements on a single-segment Proteon ProNET-4 4 Mbps 802.5 token ring with heterogeneous nodes are discussed. Author

N92-33816# Rolls-Royce Ltd., Derby (England).
THE ENVIRONMENT MONITOR
Robert A. H. Methuen 2 Apr. 1991 8 p Presented at the 1991 DECUS Conference, Conventry, England, 20 Mar. 1991
(PNR-90843; ETN-92-92178) Copyright Avail: CASI HC A02/MF A01

A supervisory system used to monitor over 200 inputs from temperature and humidity sensors and various items of a plant is described. The plant includes three main and one subsidiary computer halls and several plant rooms, all operated from one central area. hence, the operators require immediate notification of any environmental malfunctions. The system uses a PDP 11/02 with the RT-11 operating system and is entirely memory resident. It includes a sophisticated macro generated data base, and incorporates multithreaded code enabling a degree of multitasking. Recently the system was extended to permit the control of a remote satellite system using DEC DDCMP protocols and the automatic disconnection of remote communication links. It is a good demonstration of the capabilities of RT-11 in a dedicated single user environment. ESA

N92-33920# Maryland Univ., College Park. Dept. of Computer Science.
DISTRIBUTED SYSTEMS: INTERCONNECTION AND FAULT TOLERANCE STUDIES Final Report
Ashok Agawala and Satish Tripathi Jan. 1992 23 p
(Contract DASG60-87-C-0066)
(AD-A252869) Avail: CASI HC A03/MF A01

The goal of this project was to study the primary design and implementation issues in distributed implementation of hard real-time systems. We organized the effort under a project named MARUTI and defined the goal as the creation of an environment for the development and deployment of applications with hard real-time, fault tolerance, and security requirements. Good examples of such embedded systems are found in signal processing and avionics applications. Such applications must be able to execute on a distributed, heterogeneous hardware base. During the past three years we have created a framework for such an environment and have demonstrated the feasibility of the design through initial implementations of the prototype components of the MARUTI Environment. In this proposal, we outline the research effort that we propose to undertake over the next three years. The design of the MARUTI Environment is motivated by the requirements of the next generation of applications. In the rest of this section we present some details of these requirements. GRA

N92-33966# Texas Univ., Austin. Fusion Research Center.
MDI: MATHEMATICA DATABASE INTERFACE FOR THE MFEDB
J. C. Wiley, W. H. Miner, Jr., and D. W. Ross Apr. 1992 81 p
(Contract DE-FG05-88ER-53266)
(DE92-014337; DOE/ER-53266/39; FRCR-411) Avail: CASI HC A05/MF A01

We describe a new interface for the Magnetic Fusion Energy Database, MFEDB, which uses Mathematica(reg sign) as a front end. MDI is a Mathematica package that defines a basic set of MFEDB access functions. The package will also accept standard SQL queries. Each function returns Mathematica-style lists, which can then be manipulated with any of the Mathematica functions. MDI also provides some utility functions for plotting and analyzing the data. The MDI package essentially makes the MFEDB an extension of Mathematica. The user may use any of the many Mathematica front-ends including telnet, X-Windows, or a notebook. The mdi.m package may be obtained by anonymous FTP from

the MFEDB site or by use of netmfe, an E-mail database interface. MDI is a example of distributed computing. Behind the user interface, MDI calls an RPC client program that communicates with an RPC server on the MFEDB computer. It relies on the network communication capabilities of Mathematica to connect the user to a workstation running the Mathematica kernel. The Mathematica kernel is then connected to the MFEDB host workstation by a client/server pair of RPC processes. If the Mathematica kernel is to be run on the users' machine, the RPC client program must also be obtained and installed. The MDI RPC server is also available for users who would like to provide their own client software. The server returns ASCII tables from standards queries and may be accessed and processed by any program on the internet that has access to RPC services. DOE

N92-34008# Utrecht State Univ. (Netherlands). Dept. of Computer Science.
RANDOMIZED MULTI-PACKET ROUTING ON MESHES
Michael Kaufmann (Max-Planck-Inst. fuer Informatik, Saarbruecken, Germany, F.R.) and Jop F. Sibeyn Dec. 1991 28 p Sponsored in part by Netherlands Foundation for Computer Science
(Contract EEC-3075)
(RUU-CS-91-48; ETN-92-91814) Avail: CASI HC A03/MF A01

Randomized algorithms for routing k permutations are presented. Optimality was achieved for all k greater than or equal to 8. For the cutthrough routing problem, for routing with wraparounds, and for routing in higher dimensions, surprisingly sharp results were also proved. ESA

N92-34011# Texas Univ., Austin.
PARALLEL SUPERCOMPUTING: ADVANCED METHODS, ALGORITHMS, AND SOFTWARE FOR LARGE-SCALE PROBLEMS
G. F. Carey and D. M. Young Apr. 1992 8 p
(Contract DE-FG05-87ER-25048)
(DE92-014236; DOE/ER-25048/4) Avail: CASI HC A02/MF A01

Research has continued with excellent progress and new results on methodology and algorithms. We have also made supporting benchmark application studies on representative parallel computing architectures. Results from these research studies have been reported at scientific meetings, as technical reports and as journal publications. A list of pertinent presentations and publications is attached. The work on parallel element-by-element techniques and domain decomposition schemes has developed well. In particular, we have focused on the use of finite element spectral methods (or high p methods) on distributed massively parallel systems. The approach has been implemented in a prototype finite element program for solution of coupled Navier-Stokes flow and transport processes. This class of problems is of fundamental interest and basic to many 'grand challenge' type problems for which parallel supercomputing is warranted. DOE

N92-34108*# Research Inst. for Computing and Information Systems, Houston, TX.
A RELIABLE MULTICAST FOR XTP Interim Report
Bert J. Dempsey (Digital Technology, Inc., Champaign, IL.) and Alfred C. Weaver (Digital Technology, Inc., Champaign, IL.) Aug. 1990 10 p
(Contract NCC9-16; RICIS Proj. SE-31)
(NASA-CR-190632; NAS 1.26:190632) Avail: CASI HC A02/MF A01

Multicast services needed for current distributed applications on LAN's fall generally into one of three categories: datagram, semi-reliable, and reliable. Transport layer multicast datagrams represent unreliable service in which the transmitting context 'fires and forgets'. XTP executes these semantics when the MULTI and NOERR mode bits are both set. Distributing sensor data and other applications in which application-level error recovery strategies are appropriate benefit from the efficiency in multidestination delivery offered by datagram service. Semi-reliable service refers to multicasting in which the control algorithms of the transport layer--error, flow, and rate control--are used in transferring the multicast distribution to the set of receiving contexts, the multicast group. The multicast defined in XTP provides semi-reliable service. Since, under a semi-reliable service, joining a multicast group means listening on the group address and entails no coordination with other members, a semi-reliable facility can be used for communication between a client and a server group as well as true peer-to-peer group communication. Resource location in a LAN is an important application domain. The term 'semi-reliable' refers to the fact that group membership changes go undetected. No attempt is made to assess the current membership of the group at any time--before, during, or after--the data transfer.
Author

N92-34200*# Virginia Univ., Charlottesville. Dept. of Computer Science.
MENTAT/A: MEDIUM GRAIN PARALLEL PROCESSING Final Report, 1 Sep. 1990 - 31 Aug. 1992
Andrew S. Grimshaw 5 Oct. 1992 51 p
(Grant NAG1-1181)
(NASA-CR-190891; NAS 1.26:190891) Avail: CASI HC A04/MF A01

The objective of this project is to test the Algorithm to Architecture Mapping Model (ATAMM) firing rules using the Mentat run-time system and the Mentat Programming Language (MPL). A special version of Mentat, Mentat/A (Mentat/ATAMM) was constructed. This required changes to: (1) modify the run-time system to control queue length and inhibit actor firing until required data tokens are available and space is available in the input queues of all of the direct descendent actors; (2) disallow the specification of persistent object classes in the MPL; and (3) permit only decision free graphs in the MPL. We were successful in implementing the spirit of the plan, although some goals changed as we came to better understand the problem. We report on what we accomplished and the lessons we learned. The Mentat/A run-time system is discussed, and we briefly present the compiler. We present results for three applications and conclude with a summary and some observations. Appendix A contains a list of technical reports and published papers partially supported by the grant. Appendix B contains listings for the three applications. Author

N92-33339*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SATWG NETWORKED QUALITY FUNCTION DEPLOYMENT
Don Brown *In its* Third SEI Technical Interchange: Proceedings 1992 p 483-488 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N92-33416 McGill Univ., Montreal (Quebec). Dept. of Electrical Engineering.
ROBUST ADAPTIVE CONTROL: A BEZOUT APPROACH Ph.D. Thesis
Hubert Cantalloube May 1989 209 p
(ISBN-0-315-63451-0; CTN-92-60557) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

An adequate definition of stability for linear, discrete time, invariant, infinite order systems, and factorization properties in the corresponding space of transfer functions, leads to the design of finite order robust controllers. Moreover, this class of controllers is shown to stabilize stochastic systems. The stabilization by a class of robust adaptive controllers, of non-necessarily minimum phase stochastic linear systems (with possibly unknown or heterogeneous delay) is proved. The installations considered may be slowly time-varying. Computer simulations illustrate the

advantages of this approach. Compared with the standard recursive least squares and stochastic gradient algorithms, the proposed control algorithm is more satisfying. Compared with fixed control techniques such as H(infinity) optimization, the adaptive control technique is shown to have at least a wider range of use, but lower performance. Author (CISTI)

N92-33419 McGill Univ., Montreal (Quebec). Dept. of Electrical Engineering.
COMPUTATIONALLY EFFICIENT ADAPTIVE CONTROL ALGORITHMS FOR MARKOV CHAINS Ph.D. Thesis
Jalali Nadoushan Ahmad Jan. 1990 114 p
(ISBN-0-315-63631-9; CTN-92-60558) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

Iterative algorithms are proposed for adaptive long-run average cost control of finite state Markov chains. The algorithms estimate the unknown parameter using a strongly consistent estimator, and use this estimate to update the control policy. No prior knowledge of the optimal control policies is assumed. The main contribution of this research is the on-line computation of an optimal control based on strongly consistent estimates of the unknown parameters. At each iteration, the actions of any number of states, as few as one or as many as all states, may be updated as long as the actions of the states along the sample path of the chain are updated in the order that those states are generated; in this sense, the algorithms are referred to as asynchronous as opposed to synchronous algorithms where all states must be updated simultaneously at each iteration. It is illustrated through simulation results that by updating only the actions of the states along the sample path of the chain, the algorithms reach a policy whose long-run average cost is within 5 percent of an optimal one after an amount of computation which is considerably smaller than that required by value iteration of dynamic programming. The algorithms converge to a stationary optimal policy in finite time.
Author (CISTI)

N92-33912# Oxford Univ. (England). Dept. of Engineering Science.
H INFINITY DESIGN FOR THE MAXIMIZATION OF RELATIVE STABILITY MARGINS
B. Kouvaritakis, M. Crews, and R. W. Daniel 1991 27 p Sponsored by Science Research Council and AF
(OUEL-1901/91; ETN-92-92059) Avail: CASI HC A03/MF A01

A 'shifted' H infinity control design approach which optimizes the relative stability margin of a perturbed system as measured by the minimum distance over the class of uncertainty from the imaginary axis to the system's closed loop poles is presented.
ESA

N92-33914# Oxford Univ. (England). Robotics Reseach Group.
SPOKEN LETTER RECOGNITION WITH NEURAL NETWORKS
Jake Reynolds and Lionel Tarassenko 1991 31 p Sponsored by Science Research Council
(OUEL-1907/91; ETN-92-92061) Avail: CASI HC A03/MF A01

A strategy for optimizing a neural network known as the Radial Basis Function classifier (RBF) on a large spoken letter recognition problem is developed. The strategy can be viewed as a compromise between a fully adaptive approach involving prohibitively large amounts of computation, and a heuristic approach resulting in poor generalization. A value for the optimal number of kernel functions is suggested, and methods for determining the positions of the centers and the values of kernel function widths are provided. During the evolution of the optimization strategy it was demonstrated that spatial organization of the centers does not adversely affect the ability of the classifier to generalize. An RBF employing the optimization strategy achieved a lower error rate than Woodland's multilayer perceptron and two traditional static pattern classifiers in the same problem. The error rate of the RBF was very close to the predicted minimum error rate obtainable with an optimal Bayesian classifier. An examination of the computational requirements of the classifiers illustrated a significant tradeoff between the computational investment in training and level of generalization achieved. ESA

N92-34146*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
KINEMATIC EQUATIONS FOR CONTROL OF THE REDUNDANT EIGHT-DEGREE-OF-FREEDOM ADVANCED RESEARCH MANIPULATOR 2
Robert L. Williams, II Aug. 1992 28 p
(RTOP 590-11-22-01)
(NASA-TM-4377; L-16944; NAS 1.15:4377) Avail: CASI HC A03/MF A01

The forward position and velocity kinematics for the redundant eight-degree-of-freedom Advanced Research Manipulator 2 (ARM2) are presented. Inverse position and velocity kinematic solutions are also presented. The approach in this paper is to specify two of the unknowns and solve for the remaining six unknowns. Two unknowns can be specified with two restrictions. First, the elbow joint angle and rate cannot be specified because they are known from the end-effector position and velocity. Second, one unknown must be specified from the four-jointed wrist, and the second from joints that translate the wrist, elbow joint excluded. There are eight solutions to the inverse position problem. The inverse velocity solution is unique, assuming the Jacobian matrix is not singular. A discussion of singularities is based on specifying two joint rates and analyzing the reduced Jacobian matrix. When this matrix is singular, the generalized inverse may be used as an alternate solution. Computer simulations were developed to verify the equations. Examples demonstrate agreement between forward and inverse solutions. Author

N92-34190*# Houston Univ., TX. Dept. of Psychology.
AN EVALUATION OF TRAINING EFFECTIVENESS OF AN INTELLIGENT TUTORING SYSTEM
Debra Steele Johnson, Kalen F. Pieper, and Chris Culbert 9 Oct. 1992 72 p
(Grant NAG9-555)
(NASA-CR-190916; NAS 1.26:190916) Avail: CASI HC A04/MF A01

The study evaluated the training effectiveness of an intelligent tutoring system (ITS) for the Remote Manipulator System (RMS). The study examined how well individuals learn the training content and skills from the RMS ITS and to what extent the content and skills learned using the ITS transfer to RMS task performance in the SES, a high fidelity simulator. Three astronauts completed 8 2-hour ITS sessions addressing movement in three coordinate systems, grapple, ungrapple, berth, and unberth procedures, and singularities and reach limits. Their performance was also observed in an SES training session. Performance data were collected using multiple measures: ITS task performance, transfer performance on the SES, a conceptual knowledge test, an opinion survey completed by astronauts, and comments and observations from astronauts and trainers. Results indicated the RMS ITS to be moderately effective and provided evidence of the efficacy of ITS's, in general. Comments and suggestions are provided relating to how the ITS could be improved and to enable decision makers to judge the effectiveness of the RMS ITS. Author

N92-34240*# National Aeronautics and Space Administration. Pasadena Office, CA.
CASCADED VLSI NEURAL NETWORK ARCHITECTURE FOR ON-LINE LEARNING Patent Application
Anilkumar P. Thakoor, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), Tuan A. Duong, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), and Taher Daud, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 4 Sep. 1992 45 p
(Contract NAS7-918)
(NASA-Case-NPO-18645-1-CU; NAS 1.71:NPO-18645-1-CU; US-Patent-Appl-SN-941335) Avail: CASI HC A03/MF A01

High-speed, analog, fully-parallel, and asynchronous building blocks are cascaded for larger sizes and enhanced resolution. A hardware compatible algorithm permits hardware-in-the-loop

learning despite limited weight resolution. A computation intensive feature classification application was demonstrated with this flexible hardware and new algorithm at high speed. This result indicates that these building block chips can be embedded as an application specific coprocessor for solving real world problems at extremely high data rates. NASA

N92-33459# Imperial Coll. of Science and Technology, London (England).
THE TELESCIENCE CONCEPT AND ITS APPLICATION TO MANNED AND UNMANNED SPACE MISSIONS
A. Balogh *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 11-19 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N92-33252# RAND Corp., Santa Monica, CA.
MONOTONE POLYGON INTERSECTION: GEOMETRY, COMPUTER APPLICATIONS, AND COMPUTER GRAPHICS
Darrell Harvey Shane 1991 23 p
(Contract MDA903-90-C-0004)
(AD-A252538; RAND/N-3298-DARPA) Avail: CASI HC A02/MF A01

Spatial queries are a fundamental class of queries on geographic data that consist primarily of points, lines, and polygons. Enhancing response time of spatial queries requires a spatial index. The chaintree is a dynamic spatial index structure being developed at RAND, based on a regular planar straight line graph. The chaintree organizes polygons to efficiently answer spatial queries. An operation basic to most chaintree procedures is polygon intersection. This note presents a new algorithm for finding the intersection of two uniformly monotone polygons in linear time and space without preprocessing. GRA

N92-33284# Pittsburgh Univ., PA. Dept. of Mathematics and Statistics.
ON THE COMPUTATION OF IMPASSE POINTS OF QUASILINEAR DIFFERENTIAL ALGEBRAIC EQUATIONS
Patrick J. Rabier and Werner C. Rheinboldt Jun. 1992 35 p
Sponsored in part by NSF and DOD
(Contract N00014-90-J-1025; NSF CCR-89-07654; AF-AFOSR-0094-90)
(AD-A253067; ICMA-92-172) Avail: CASI HC A03/MF A01

We present computational algorithms for the calculation of impasse points and higher order singularities in quasilinear differential-algebraic equations. Our method combines a reduction step transforming the DAE into a singular ODE with an augmentation procedure inspired by numerical bifurcation theory. Singularities are characterized by the vanishing of a scalar quantity that may be monitored along any trajectory. Two numerical examples with physical relevance are given. GRA

N92-33294# Allied-Signal Aerospace Co., Kansas City, MO.
AN EXPONENTIAL CURVE FITTING PROBLEM WITH DATA HAVING NEAR INFINITE SLOPE CLOSE TO THE ORIGIN
L. L. Dixon, Jr. May 1992 16 p
(Contract DE-AC04-76DP-00613)
(DE92-015159; KCP-613-4703) Avail: CASI HC A03/MF A01

When an attempt is made to fit a curve through sharply rising data, slight deviations will generate large variations in the mode. The purpose of this paper is to discuss a procedure to fit a curve through exponentially behaved data that rises sharply near the origin. DOE

N92-33422 McGill Univ., Montreal (Quebec). Dept. of Electrical Engineering.
NORMED DOUBLE ALGEBRAS, LOCAL AND GLOBAL OPTIMIZATION, AND SLOW H-INFINITY ADAPTATION Ph.D. Thesis
Le Yi Wang 15 Oct. 1989 140 p
(ISBN-0-315-63410-3; CTN-92-60560) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

A normed space of input-output mappings equipped with two products, one global and the other local, called a normed double algebra (NDA), is introduced for the frozen-time analysis of stabilization and optimization of a class of slowly time-varying systems. Local-global relations within a NDA are established in the time and frequency domains. The local-global relations enable global properties to be deduced from the local ones. Classical frozen-time stability is reinterpreted in terms of a relation between local and global resolvents in the NDA. Relations between local and global coprime factorizations and their implications to local and global robust stability are obtained. An explicit double algebraic expression for adaptive bounded-input bounded-output sensitivity reduction is established. Notions of adaptive and robust sensitivity minimization are applied to an example. The double algebra symbolism is employed to show that adaptive minimization can give better sensitivity than H-infinity optimal robust minimization. To implement a design strategy of global sensitivity optimization by local H-infinity interpolation, Lipschitz continuity of optimal H-infinity interpolants on data is investigated. Delta-suboptimal interpolants applied to slowly time-varying systems achieve approximations to the globally optimal interpolants, which become accurate as the rates of variation approach zero. Author (CISTI)

N92-33436 McMaster Univ., Hamilton (Ontario).
ROBUST IDENTIFICATION OF BILINEAR SYSTEMS Ph.D. Thesis
Heping Dai Apr. 1990 234 p
(ISBN-0-315-57939-0; CTN-92-60561) Copyright Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada HC/MF

A thorough survey of the robust identification of linear systems was made, and existing identification methods were evaluated. Six robust on-line identification algorithms are proposed for both parameter identification and state estimation of bilinear systems. The convergence of these algorithms is established theoretically using two different techniques. Simulation examples are included to demonstrate the robustness of these methods. An off-line method, the robust iterative least squares method with modified residuals (RILSMMR), was developed for identification of both linear and bilinear systems. A convergence proof for this method is also provided. The advantage of this method over currently used robust methods was confirmed by simulation. The RILSMMR was successfully used to estimate the expansion coefficients of orthogonal function series when the time series are contaminated not only by noise but also by outliers. This makes it possible to use orthogonal functions to solve various application problems hitherto unaddressed due to the presence of noise and outliers. Two examples using Walsh and block-pulse functions for robust identification of systems are illustrated, demonstrating the advantage of these approaches over their non-robust counterparts. Author (CISTI)

N92-33556# Colorado School of Mines, Golden. Center for Wave Phenomena.
MATHEMATICA (TRADEMARK) AND THE METHOD OF STEEPEST DESCENTS, PART 1 Technical Report, 1 Jan. 1991 - 30 Sep. 1992
Norman Bleistein May 1992 21 p
(Contract N00014-91-J-1267)
(AD-A252779; CWP-103P.I-Pt-1) Avail: CASI HC A03/MF A01

Mathematica is a symbolic manipulator with graphical capabilities. During the fall 1990 semester, I used Mathematica on my NeXT workstation to create graphics for teaching the method of steepest descents. This required level curve plots and surface

plots for the real or imaginary part of functions of a complex variable. By the end of this topic in the course, I was doing near-research-level analysis of complex valued functions. The response of my class was also very positive. In this paper, I describe some of the more elementary examples discussed in the class. In Part 2, I will describe the steepest descent analysis for the Lamb problem as a representative of research level application and utility of Mathematica for this type of analysis. This is the easiest example demonstrating how refracted and evanescent waves in a layered medium are treated by the method of steepest descents with the additional enhancement of Mathematica. View Point, Plot Range, Ticks, Box Ratios. GRA

N92-33571*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
APPLICATION OF VECTOR-VALUED RATIONAL APPROXIMATIONS TO THE MATRIX EIGENVALUE PROBLEM AND CONNECTIONS WITH KRYLOV SUBSPACE METHODS
Avram Sidi (Technion - Israel Inst. of Tech., Haifa.) Sep. 1992 35 p Presented at the International Meeting on Approximation, Interpolation, and Summability, Tel-Aviv, Israel, Jun. 1990 and the International Congress on Extrapolation and Rational Approximation, Tenerife, Spain, Jan. 1992
(NASA Order C-99066-G; RTOP 505-62-21)
(NASA-TM-105858; ICOMP-92-18; E-7317; NAS 1.15:105858)
Avail: CASI HC A03/MF A01

Let F(z) be a vectored-valued function F: C approaches C sup N, which is analytic at z=0 and meromorphic in a neighborhood of z=0, and let its Maclaurin series be given. We use vector-valued rational approximation procedures for F(z) that are based on its Maclaurin series in conjunction with power iterations to develop bona fide generalizations of the power method for an arbitrary N X N matrix that may be diagonalizable or not. These generalizations can be used to obtain simultaneously several of the largest distinct eigenvalues and the corresponding invariant subspaces, and present a detailed convergence theory for them. In addition, it is shown that the generalized power methods of this work are equivalent to some Krylov subspace methods, among them the methods of Arnoldi and Lanczos. Thus, the theory provides a set of completely new results and constructions for these Krylov subspace methods. This theory suggests at the same time a new mode of usage for these Krylov subspace methods that were observed to possess computational advantages over their common mode of usage. Author

N92-33639# Technische Univ., Delft (Netherlands). Sectie Mathematische Geodesie en Puntsbepaling.
ROBUST ADJUSTMENT METHODS IN COORDINATE TRANSFORMATION Thesis [ROBUUSTE VEREFFENINGSMETHODEN BIJ DE COOERDINAATTRANSFORMATIE]
Hans Brandsma Aug. 1991 153 p In DUTCH
(ETN-92-92026) Avail: CASI HC A08/MF A02

Robust adjustment methods in geodesy are introduced and compared with the least squares method. The linear least squares method is discussed. The connection of two dimensional point fields following the linear least squares method is outlined. The robust methods are discussed taking example by the simple one dimensional model. The robustness was treated using an infinitesimal approximation. The robust M-estimators, emanating from a generalization of the maximum likelihood scatter, are interesting for geodesy, but they are not as simple as the least squares method and require iteration. It can be concluded that the robust methods are a welcome completion to the existing least squares adjustment method. ESA

N92-33695# Naval Research Lab., Washington, DC.
MATRIX REPRESENTATION OF FINITE FIELDS Interim Report, Aug. - Sep. 1991
W. P. Wardlaw 12 Mar. 1992 14 p
(Contract N00019-91-WX-C15R)
(AD-A247828; NRL/MR/5350.1-92-6953) Avail: CASI HC A03/MF A01

Finite fields (also called Galois Fields) have been studied since their introduction by Evariste Galois in 1832 and the publication of his work in 1846. In the last few decades, finite fields have become important to information theory, coding theory, and cryptography. This report presents a simple method for representing a finite field in terms of powers of a single matrix over the integers modulo the characteristic of the field. The addition and multiplication in the field are immediately obtained as the results of ordinary matrix addition and multiplication. This representation called the canonical cyclic representation, makes it easy to understand the field structure and to carry out computations in the field. GRA

N92-33711# Los Alamos National Lab., NM.
NUMERICAL SIMULATIONS OF THE DERIVATIVE NONLINEAR SCHROEDINGER EQUATION
S. P. Dawson 1992 8 p Presented at the 7th International Association of Mathematics and Computer Simulation (IMACS) International Conference on Computer Methods for Partial Differential Equations, New Brunswick, NJ, 22-24 Jun. 1992
(Contract W-7405-eng-36)
(DE92-015146; LA-UR-92-1569; CONF-9206185-1) Avail: CASI HC A02/MF A01

We study the numerical integration of the derivative nonlinear Schrodinger equation: iqt minus i(absolute value of q(sup 2) q)sub x + q(sub x)(sub x) = 0 which is an integrable equation originally obtained as a model for the propagation of finite amplitude Alfven waves in the presence of sound waves. The numerical simulations we present have been obtained using a code introduced by S. Ponce Dawson, and C. Ferro Fontain J. Comp. Phys. 76.192 (1988). This code is a local version of a global finite difference scheme that is integrable and that was inspired in the works by Ablowitz and Ladik and Taha and Ablowitz for the nonlinear Schrodinger equation. We have already studied the performance of the code for normal solitons and for an initially strongly unstable plane wave modulated with a gaussian. In this work we extend this study to weakly unstable initial conditions. In particular we study the evolution from an initial plane wave which is an exact, but unstable, solution of the equation under periodic boundary conditions, onto which we superimpose some perturbations. We analyze whether the code gives the right growth rates of the instabilities both in the weakly and in the strongly unstable cases. DOE

N92-33736# Colorado School of Mines Research Foundation, Inc., Golden. Center for Wave Phenomena.
MATHEMATICA (TM) AND THE METHOD OF STEEPEST DESCENTS, PART 2
Norman Bleistein 1992 17 p
(AD-A252502; CWP-103P.II-Pt-2) Avail: CASI HC A02/MF A01

Mathematica is a symbolic manipulator with graphical capabilities. During the fall 1990 semester, I used Mathematica on my NeXT workstation to create graphics for teaching the method of steepest descents. This required level curve plots and surface plots for the real or imaginary part of functions of a complex variable. By the end of this topic in the course, I was doing near-research-level analysis of complex valued functions. The response of my class was also very positive. In Part 1 of this paper, I described some of the more elementary examples presented in that class. Here, I describe the application of the technique to the problem of scattering by a half plane, including the analysis of the exponent that leads to refracted and evanescent waves in a layered medium. GRA

N92-33742*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
UPPER BOUNDS FOR CONVERGENCE RATES OF VECTOR EXTRAPOLATION METHODS ON LINEAR SYSTEMS WITH INITIAL ITERATIONS Ph.D. Thesis
Avram Sidi (Technion - Israel Inst. of Tech., Haifa.) and Yair Shapira (Technion - Israel Inst. of Tech., Haifa.) Jul. 1992 58 p
(RTOP 505-62-21)
(NASA-TM-105608; E-6946; NAS 1.15:105608; ICOMP-92-09)
Avail: CASI HC A04/MF A01

The application of the minimal polynomial extrapolation (MPE)

and the reduced rank extrapolation (RRE) to a vector sequence obtained by the linear iterative technique x(sub j) + 1 = Ax(sub j) = b,j = 1,2,..., is considered. Both methods produce a two dimensional array of approximations s(sub n,k) to the solution of the system (I - A)x = b. Here, s(sub n,k) is obtained from the vectors x(sub j), n is less than or equal to j is less than or equal to n + k + 1. It was observed in an earlier publication by the first author that the sequence s(sub n,k), k = 1,2,..., for n greater than 0, but fixed, possesses better convergence properties than the sequence s(sub 0,k), k = 1,2,.... A detailed theoretical explanation for this phenomenon is provided in the present work. This explanation is heavily based on approximations by incomplete polynomials. It is demonstrated by numerical examples when the matrix A is sparse that cycling with s(sub n,k) for n greater than 0, but fixed, produces better convergence rates and costs less computationally than cycling with s(sub 0,k). It is also illustrated numerically with a convection-diffusion problem that the former may produce excellent results where the latter may fail completely. As has been shown in an earlier publication, the results produced by s(sub 0,k) are identical to the corresponding results obtained by applying the Arnoldi method or generalized minimal residual scheme (GMRES) to the system (I - A)x = b. Author

N92-33807# Technische Univ., Berlin (Germany, F.R.). Fachbereich Mathematik.
Lp ERROR ESTIMATIONS AND SUPRACONVERGENCE IN TIME CONTINUOUS DIFFERENCE APPROXIMATIONS OF LINEAR PARABOLIC INITIAL BOUNDARY VALUE PROBLEMS Ph.D. Thesis [LP-FEHLERABSCHAETZUNGEN UND SUPRAKONVERGENZ BEI ZETIKONTINUIERLICHEN DIFFERENZENAPPROXIMATIONEN VON LINEAREN PARABOLISCHEN ANFANGSRANDWERTPROBLEMEN]
Ulrike Ketterl 1991 103 p In GERMAN
(ETN-92-92137) Avail: CASI HC A06/MF A02

Two different error estimations for time continuous difference approximations of linear parabolic initial boundary value problems are demonstrated for the one dimensional case. The A differential operator was taken as time independent and of second order. The solution of time continuous difference approximation is given using the semigroup produced by the difference operation. The first apriori estimation is valid for time continuous difference approximations of a parabolic initiation boundary value problem on equidistant grids. The evidence of the first and second stability estimation is represented. An application example emphasizes the supraconvergence of a non equidistant discretization scheme. Numerical examples are presented. ESA

N92-33819 Texas Univ., Arlington.
TIME DOMAIN SOLUTIONS OF MAXWELL'S EQUATIONS USING A FINITE-VOLUME FORMULATION Ph.D. Thesis
Ralph Wayne Noack 1991 82 p
Avail: Univ. Microfilms Order No. DA9131757

A new method for solving Maxwell's equations in the time domain was developed. The method approximates the integral form of the time-dependent Maxwell's equations using a finite-volume formulation. The method utilizes a staggered mesh and requires boundary conditions on the electric field or the magnetic field but not both. Predictions from the present method were compared to exact solutions for a full three-dimensional calculation of a sphere and experimental measurements for a generic missile body. These comparisons show that the method is capable of accurately solving the time-dependent Maxwell's equations and yields accurate predictions of the radar cross section for arbitrary geometries. Dissert. Abstr.

N92-33828*# Old Dominion Univ., Norfolk, VA. Dept. of Electrical and Computer Engineering.
A NEW METHOD FOR RECOGNIZING QUADRIC SURFACES FROM RANGE DATA AND ITS APPLICATION TO TELEROBOTICS AND AUTOMATION Progress Report, period ending 31 Aug. 1992
Nicolas Alvertos and Ivan DCunha Sep. 1992 18 p
(Grant NAG1-1223)
(NASA-CR-190834; NAS 1.26:190834) Avail: CASI HC A03/MF A01

Pose and orientation of an object is one of the central issues in 3-D recognition problems. Most of today's available techniques require considerable pre-processing such as detecting edges or joints, fitting curves or surfaces to segment images, and trying to extract higher order features from the input images. We present a method based on analytical geometry, whereby all the rotation parameters of any quadric surface are determined and subsequently eliminated. This procedure is iterative in nature and was found to converge to the desired results in as few as three iterations. The approach enables us to position the quadric surface in a desired coordinate system, and then to utilize the presented shape information to explicitly represent and recognize the 3-D surface. Experiments were conducted with simulated data for objects such as hyperboloid of one and two sheets, elliptic and hyperbolic paraboloid, elliptic and hyperbolic cylinders, ellipsoids, and quadric cones. Real data of quadric cones and cylinders were also utilized. Both of these sets yielded excellent results. Author

N92-33868*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ANALYTICAL GUIDANCE LAW DEVELOPMENT FOR AEROCAPTURE AT MARS Progress Report No. 4, 1 Nov. 1991 - 31 Jul. 1992
A. J. Calise Jul. 1992 23 p
(Grant NAG1-1139)
(NASA-CR-190615; NAS 1.26:190615) Avail: CASI HC A03/MF A01

During the first part of this reporting period research has concentrated on performing a detailed evaluation, to zero order, of the guidance algorithm developed in the first period taking the numerical approach developed in the third period. A zero order matched asymptotic expansion (MAE) solution that closely satisfies a set of 6 implicit equations in 6 unknowns to an accuracy of 10(exp -10), was evaluated. Guidance law implementation entails treating the current state as a new initial state and repetitively solving the MAE problem to obtain the feedback controls. A zero order guided solution was evaluated and compared with optimal solution that was obtained by numerical methods. Numerical experience shows that the zero order guided solution is close to optimal solution, and that the zero order MAE outer solution plays a critical role in accounting for the variations in Loh's term near the exit phase of the maneuver. However, the deficiency that remains in several of the critical variables indicates the need for a first order correction. During the second part of this period, methods for computing a first order correction were explored.
Author

N92-33909# Winand Staring Centre, Wageningen (Netherlands). Agricultural Research Dept.
RANKING A SET OF OBJECTS ON THE BASIS OF A PREFERENCE MATRIX
W. vanDoorne 1991 23 p
(Rept-51; ETN-92-92055) Copyright Avail: CASI HC A03/MF A01

The use of a preference matrix containing the paired comparisons in a set of objects to arrange the objects by means of a simple and natural evaluation criterion for sequences of objects is described. The algorithm is essentially a permutation method and finds the optimal rankings by maximizing the criterion value. It avoids many nonpromising arrangements by calculating bounds for certain statistics and dropping permutations which do not satisfy these bounds. The evaluation criterion also provides a means of finding near optimal rankings. The calculation efforts required by permutation methods tend to be exponentially related to the number of objects. The same is true for the algorithm that is proposed, but there is one essential difference: the trend is increasingly less steep for an increasing number of objects when compared to simple permutation methods. About 25 objects can be arranged on a VAX 4300 computer within a few minutes of run time whereas with other permutation methods this might take hours. ESA

N92-34073# Argonne National Lab., IL. Mathematics and Computer Science Div.
HYBRID EVALUATION OF SECOND DERIVATIVES IN ADIFOR Report No. 8
C. Bischof, G. Corliss, and A. Griewank May 1992 46 p
(Contract W-31-109-eng-38)
(DE92-015360; ANL/MCS-TM-166) Avail: CASI HC A03/MF A01

Many algorithms for scientific computation require second- or higher-order partial derivatives, which can be efficiently computed by propagating a set of univariate Taylor series. We describe how to implement second-order mixed partial derivative computations in ADIFOR (Automatic Differentiation In FORtran), a Fortran-to-Fortran source transformation tool. Globally, we propagate three-term univariate Taylor series in the forward mode. Locally, we preaccumulate local gradients and Hessians for complicated expressions on the right-hand sides of assignment statements. We describe the source transformations and give an example of the transformed code. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N92-33531# Air Force Inst. of Tech., Wright-Patterson AFB, OH.
FINDING AN H-FUNCTION DISTRIBUTION FOR THE SUM OF INDEPENDENT H-FUNCTION VARIATES Ph.D. Thesis
Carl D. Bodenschatz May 1992 233 p
(AD-A252517; AFIT/CI/CIA-92-005D) Avail: CASI HC A11/MF A03

A practical method of finding an H-function distribution for the sum of two or more independent H-function variates is presented. Simple formulas exist which immediately give the probability density function, as an H-function distribution, of the random variable defined as the product, quotient, or power of independent H-function variates. Unfortunately, there are no similar formulas for the sum or difference of independent H-function variates. The new practical technique finds an H-function distribution whose moments closely match the moments of the random variable defined as the sum of independent H-function variates. This allows an analyst to find the distribution of more complicated algebraic combinations of independent random variables. The method and implementing computer program are demonstrated through five examples. For comparison, the exact distribution of the general sum of independent Erlang variates with different scale parameters is derived using Laplace transforms and partial fractions decomposition. GRA

N92-33701# National Inst. for Fusion Science, Nagoya (Japan).
A METHOD FOR THE HIGH-SPEED GENERATION OF RANDOM NUMBERS WITH ARBITRARY DISTRIBUTIONS
T. Ishikawa (Gunma Univ., Maebashi, Japan), P. Y. Wang (Gunma Univ., Maebashi, Japan), K. Wakui (Gunma Univ., Maebashi, Japan), and T. Yabe (Gunma Univ., Maebashi, Japan) Nov. 1991 28 p Sponsored in part by Ministry of Education, Science and Culture
(NIFS-121) Avail: CASI HC A03/MF A01

A new method for the high-speed generation of random numbers with arbitrary distributions is proposed. The method stores random numbers in two memories, and then picks out two random numbers and assembles them, resulting in a new random number. When the method is realized with Fortran, the method can generate random numbers with normal distribution about eleven times faster than methods that use the central limit theorem and can generate random numbers with Planck distribution about nine times faster than the acceptance-rejection method. The method is realized by hardware. The system generates 5(10)(exp 6) random numbers per second with any distribution. The statistical quality of these random numbers is similar to or better than that of conventional methods. Author

N92-33732# Naval Air Warfare Center, Warminster, PA. Aircraft Div.
FINITE HORIZON H INFINITY WITH PARAMETER VARIATIONS Interim Report, Jan. - May 1992
M. B. Subrahmanyam May 1992 20 p
(NR Proj. R36-24)
(AD-A252419; NAWCADWAR-TN-92041-60) Avail: CASI HC A02/MF A01

In this technical note, we consider the finite horizon H infinity performance robustness problem with parameter variations. Assuming a nominal model, an iterative procedure is given to synthesize a suboptimal H controller, which yields the required performance even under parameter variations. As a by-product, an expression for the variation of performance owing to parameter variations is given. An example which illustrates the methodology is worked out under parameter uncertainties. GRA

N92-33911# Groningen Rijksuniv. (Netherlands). Dept. of Mathematics.
ON REGRESSION REPRESENTATIONS OF STOCHASTIC PROCESSES
Ludger Rueschendorf (Muenster Univ., Germany, F.R.) and Vincent deValk 1991 21 p
(W-9106; ETN-92-92058) Avail: CASI HC A03/MF A01

Nonlinear regression representations of general stochastic processes (X(sub n)), (n a member of the set N) are constructed. As a consequence, in particular, special regression representations of Markov chains and of certain m dependent sequences are obtained. For m dependent sequences, a constructive method to check whether these sequences have a monotone m+1-block factor representation is obtained. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N92-33427# Los Alamos National Lab., NM.
CRISIS STABILITY OF SPACE-BASED DEFENSES
G. H. Canavan Jun. 1992 9 p
(Contract W-7405-eng-36)
(DE92-015814; LA-12310-MS) Avail: CASI HC A02/MF A01

Deploying space-based interceptors (SBI's) to defend offensive forces dominated by submarine-launched ballistic missiles (SLBM's) increases crisis stability. SBI's increase the fraction of land missiles and aircraft that survive the first strike, which is stabilizing. For small numbers of SLBM's, first and second strikes and costs become similar, and stability increases. This note gives numerical and analytic estimates of the crisis stability of SLBM-dominated build downs stabilized with SBI's, using the stability analysis derived in earlier reports. DOE

N92-33483*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ADVANCED TECHNIQUES IN RELIABILITY MODEL REPRESENTATION AND SOLUTION
Daniel L. Palumbo and David M. Nicol (College of William and Mary, Williamsburg, VA.) Oct. 1992 18 p
(RTOP 505-64-10-07)
(NASA-TP-3242; L-17048; NAS 1.60:3242) Avail: CASI HC A03/MF A01

The current tendency of flight control system designs is towards increased integration of applications and increased distribution of computational elements. The reliability analysis of such systems is difficult because subsystem interactions are increasingly interdependent. Researchers at NASA Langley Research Center have been working for several years to extend the capability of Markov modeling techniques to address these problems. This effort has been focused in the areas of increased model abstraction and increased computational capability. The reliability model generator (RMG) is a software tool that uses as input a graphical

object-oriented block diagram of the system. RMG uses a failure-effects algorithm to produce the reliability model from the graphical description. The ASSURE software tool is a parallel processing program that uses the semi-Markov unreliability range evaluator (SURE) solution technique and the abstract semi-Markov specification interface to the SURE tool (ASSIST) modeling language. A failure modes-effects simulation is used by ASSURE. These tools were used to analyze a significant portion of a complex flight control system. The successful combination of the power of graphical representation, automated model generation, and parallel computation leads to the conclusion that distributed fault-tolerant system architectures can now be analyzed. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N92-33740# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
KLEINIAN GROUPS IN S3 WHICH ARE EXTENSIONS
L. Potyagailo Nov. 1991 16 p
(PB92-134394; IHES/M/91/79) Avail: CASI HC A03/MF A01

The main objects are discontinuous (Kleinian) subgroups of the group M(n) of conformal transformations of bar-R(sup n) = S(sup n) union (infinity). Author

N92-33942*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
RATIONAL APPROXIMATIONS FROM POWER SERIES OF VECTOR-VALUED MEROMORPHIC FUNCTIONS
Avram Sidi (Technion - Israel Inst. of Tech., Haifa.) Sep. 1992 25 p Presented at the International Meeting on Approximation, Interpolation, and Summability, Tel-Aviv, Israel, Jun. 1990, and at the International Congress on Extrapolation and Rational Approximation, Tenerife, Spain, Jan. 1992
(NASA Order C-99066-G; RTOP 505-62-21)
(NASA-TM-105859; ICOMP-92-17; E-7318; NAS 1.15:105859)
Avail: CASI HC A03/MF A01

Let F(z) be a vector-valued function, F: C yields C(sup N), which is analytic at z = 0 and meromorphic in a neighborhood of z = 0, and let its Maclaurin series be given. In this work we developed vector-valued rational approximation procedures for F(z) by applying vector extrapolation methods to the sequence of partial sums of its Maclaurin series. We analyzed some of the algebraic and analytic properties of the rational approximations thus obtained, and showed that they were akin to Pade approximations. In particular, we proved a Koenig type theorem concerning their poles and a de Montessus type theorem concerning their uniform convergence. We showed how optical approximations to multiple poles and to Laurent expansions about these poles can be constructed. Extensions of the procedures above and the accompanying theoretical results to functions defined in arbitrary linear spaces was also considered. One of the most interesting and immediate applications of the results of this work is to the matrix eigenvalue problem. In a forthcoming paper we exploited the developments of the present work to devise bona fide generalizations of the classical power method that are especially suitable for very large and sparse matrices. These generalizations can be used to approximate simultaneously several of the largest distinct eigenvalues and corresponding eigenvectors and invariant subspaces of arbitrary matrices which may or may not be diagonalizable, and are very closely related with known Krylov subspace methods. Author

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N92-33250# Naval Command, Control and Ocean Surveillance Center, San Diego, CA. Electronic Test Branch.
LIQUID ENVIRONMENTAL STRESS SCREENING Final Report, Oct. 1988 - Aug. 1990
J. L. Walker May 1992 21 p
(AD-A252282; NRAD-TR-1498) Avail: CASI HC A03/MF A01

This report describes a method of performing Environmental Stress Screening in an inert fluid. Because the liquid has a high dielectric strength, the items being screened can be energized and operational while submerged. Transmitting vibrations through the liquid to the item being screened permits screening without the use of fixtures, and the liquid's high heat capacity allows very rapid temperature changes, either by pumping hot or cold liquid from remote reservoirs or by moving the device from a hot tank to a cold tank. A prototype screening system has been built at NRaD, and faults induced in a small (47 pieces) lot of printed wiring boards have been detected. GRA

N92-33350*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
PROCEEDINGS OF THE 23RD ANNUAL PRECISE TIME AND TIME INTERVAL (PTTI) APPLICATIONS AND PLANNING MEETING
Richard L. Sydnor, ed. (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) et al Washington Jul. 1992 440 p Meeting held in Pasadena, CA, 3-5 Dec. 1991; sponsored by NASA. Goddard Space Flight Cetner, JPL, Naval Observatory, Space and Naval Warfare Systems Command, NRL, Army Electronics Technology and Devices Lab., and AFOSR
(Contract NAS5-31000)
(NASA-CP-3159; Rept-92B00083; NAS 1.55:3159) Avail: CASI HC A19/MF A04

A compilation of technical papers, from the 23rd annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting, is presented. Papers were given in the following categories: (1) developments in rubidium, cesium, and hydrogen-based frequency standards, and in cryogenic and trapped-ion technology; (2) international and transnational applications of PTTI technology with emphasis on satellite laser tracking networks, GLONASS timing, comparison of national time scales and international communications; (3) applications of PTTI technology to the telecommunications, power distribution, platform positioning, and geophysical survey industries; (4) applications of PTTI technology to evolving military communications and navigation systems; and (5) dissemination of precise time and frequency by means of GPS, GLONASS, MILSTAR, Loran, and synchronous communications satellites. For individual titles, see N92-33351 through N92-33387.

N92-33351*# Bureau International des Poids et Mesures, Sevres (France).
THE NEED FOR GPS STANDARDIZATION **c04**
Wlodzimierz W. Lewandowski, Gerard Petit, and Claudine Thomas *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 1-13 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

A desirable and necessary step for improvement of the accuracy of Global Positioning System (GPS) time comparisons is the establishment of common GPS standards. For this reason, the CCDS proposed the creation of a special group of experts with the objective of recommending procedures and models for operational time transfer by GPS common-view method. Since the announcement of the implementation of Selective Availability at the end of last spring, action has become much more urgent and this CCDS Group on GPS Time Transfer Standards has now been set up. It operates under the auspices of the permanent

CCDS Working Group on TAI and works in close cooperation with the Sub-Committee on Time of the Civil GPS Service Interface Committee (CGSIC). Taking as an example the implementation of SA during the first week of July 1991, this paper illustrates the need to develop urgently at least two standardized procedures in GPS receiver software: monitoring GPS tracks with a common time scale and retaining broadcast ephemeris parameters throughout the duration of a track. Other matters requiring action are the adoption of common models for atmospheric delay, a common approach to hardware design and agreement about short-term data processing. Several examples of such deficiencies in standardization are presented. Author

N92-33352*# Omega Navigation System Center, Alexandria, VA. Global Positioning System Information Center Branch.
US COAST GUARD GPS INFORMATION CENTER (GPSIC) AND ITS FUNCTION WITHIN THE CIVIL GPS SERVICE (CGS) **c04**
Luann Barndt *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 15-34 Revised (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The Global Positioning System Information Center (GPSIC) was created to provide civil users of the Global Positioning System with timely system status and other GPS satellite information. The GPSIC began providing basic services on a test and evaluation basis in March 1990. Since then we have improved these services, formalized the information gathering processes, and expanded GPSIC operations to meet GPS user needs. The GPSIC serves as a central point of contact for civil users to make their interests and needs known to the system operator, the Department of Defense (DOD) under the management of the U.S. Air Force. The GPSIC provides GPS information to civil users through Operational Advisory Broadcasts (OAB) containing GPS performance data. The OABs are disseminated through numerous sources including 24 hour access to a voice telephone recording and a computer bulletin board system (BBS). The GPSIC staff also responds to individual user inquiries, comments, or concerns about civil access to and use of the GPS during normal working hours. This paper provides an overview of the Civil GPS Service as well as the details of the type of information and services that are available through the GPSIC and how they can be obtained. It will also address the future expansion of GPSIC responsibilities. Author

N92-33353*# Aerospace Corp., El Segundo, CA.
EVALUATION OF GPS/UTC STEERING PERFORMANCE **c04**
W. A. Feess, H. Holtz, A. L. Satin, and Colleen H. Yinger *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 35-48 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The Global Positioning System (GPS) is required to maintain GPS time to Universal Coordinated Time (UTC) to an accuracy of one microsecond and broadcast to the user the offset between GPS and UTC to an accuracy of 100 nanoseconds (1 sigma). On 25 Jun. 1990, an automatic steering algorithm was implemented to control GPS time to synchronize it with UTC. The description of the steering laws and predicted performance results were presented at the 1989 Precise Time and Time Interval (PTTI) conference, while preliminary performance results were presented at the 1990 PTTI conference. The initial performance was not as predicted, resulting in an in-depth analysis of the observed performance and a more thorough sensitivity analysis. In addition, responses to anomalies were investigated. This paper will describe these analyses and results, and evaluate actual steering performance from Jun. 1990 to Nov. 1991. Although anomalies were observed during the initial phase of steering, recent experience is more in line with expectations. Author

N92-33354*# National Oceanic and Atmospheric Administration, Rockville, MD. Ocean and Earth Sciences Div.
GPS ORBIT DETERMINATION AT THE NATIONAL GEODETIC SURVEY **c04**
Mark S. Schenewerk *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 49-58 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The National Geodetic Survey (NGS) independently generates precise ephemerides for all available Global Positioning System (GPS) satellites. Beginning in 1991, these ephemerides were produced from double-differenced phase observations solely from the Cooperative International GPS Network (CIGNET) tracking sites. The double-difference technique combines simultaneous observations of two satellites from two ground stations effectively eliminating satellite and ground receiver clock errors, and the Selective Availability (S/A) signal degradation currently in effect. CIGNET is a global GPS tracking network whose primary purpose is to provide data for orbit production. The CIGNET data are collected daily at NGS and are available to the public. Each ephemeris covers a single week and is available within one month after the data were taken. Verification is by baseline repeatability and direct comparison with other ephemerides. Typically, an ephemeris is accurate at a few parts in 10(exp 7). This corresponds to a 10 meter error in the reported satellite positions. NGS is actively investigating methods to improve the accuracy of its orbits, the ultimate goal being one part in 10(exp 8) or better. The ephemerides are generally available to the public through the Coast Guard GPS Information Center or directly from NGS through the Geodetic Information Service. An overview of the techniques and software used in orbit generation will be given, the current status of CIGNET will be described, and a summary of the ephemeris verification results will be presented. Author

N92-33355*# Bureau International des Poids et Mesures, Sevres (France).
PRECISE GPS EPHEMERIDES FROM DMA AND NGS TESTED BY TIME TRANSFER **c04**
Wlodzimierz W. Lewandowski, Gerard Petit, and Claudine Thomas *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 59-70 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

It was shown that the use of the Defense Mapping Agency's (DMA) precise ephemerides brings a significant improvement to the accuracy of GPS time transfer. At present a new set of precise ephemerides produced by the National Geodetic Survey (NGS) has been made available to the timing community. This study demonstrates that both types of precise ephemerides improve long-distance GPS time transfer and remove the effects of Selective Availability (SA) degradation of broadcast ephemerides. The issue of overcoming SA is also discussed in terms of the routine availability of precise ephemerides. Author

N92-33356*# Technische Univ., Graz (Austria).
COMPARISON OF TWO-WAY SATELLITE TIME TRANSFER AND GPS COMMON-VIEW TIME TRANSFER BETWEEN OCA AND TUG **c04**
Dieter Kirchner, U. Thyr, H. Ressler, R. Robnik, P. Grudler (Observatoire de la Cote d'Azur, Nice, France), Francoise S. Baumont (Observatoire de la Cote d'Azur, Nice, France), Christian Veillet (Observatoire de la Cote d'Azur, Nice, France), Wlodzimierz W. Lewandowski (Bureau International des Poids et Mesures, Sevres, France), W. Hanson (National Inst. of Standards and Technology, Boulder, CO.), and A. Clements (National Inst. of Standards and Technology, Boulder, CO.) et al *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 71-88 Sponsored by Bureau Nationale de Metrologie; Academy of Sciences; and Austrian National Bank (For primary

document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

For about one year the time scales UTC(OCA) and UTC(TUG) were compared by means of GPS and two-way satellite time transfer. At the end of the experiment both links were independently 'calibrated' by measuring the differential delays of the GPS receivers and of the satellite earth stations by transportation of a GPS receiver and of one of the satellite terminals. The results obtained by both methods differ by about 3 ns, but reveal a seasonal variation of about 8 ns peak-to-peak which is likely the result of a temperature-dependence of the delays of the GPS receivers used. For the comparison of both methods the stabilities of the timescales are of great importance. Unfortunately, during the last three months of the experiment a less stable clock had to be used for the generation of UTC(TUG). Author

N92-33357*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SUB-NANOSECOND CLOCK SYNCHRONIZATION AND PRECISION DEEP SPACE TRACKING
Charles Dunn, Stephen Lichten, David Jefferson, and James S. Border *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 89-101 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

Interferometric spacecraft tracking is accomplished at the NASA Deep Space Network (DSN) by comparing the arrival time of electromagnetic spacecraft signals to ground antennas separated by baselines on the order of 8000 km. Clock synchronization errors within and between DSN stations directly impact the attainable tracking accuracy, with a 0.3 ns error in clock synchronization resulting in an 11 nrad angular position error. This level of synchronization is currently achieved by observing a quasar which is angularly close to the spacecraft just after the spacecraft observations. By determining the differential arrival times of the random quasar signal at the stations, clock synchronization and propagation delays within the atmosphere and within the DSN stations are calibrated. Recent developments in time transfer techniques may allow medium accuracy (50-100 nrad) spacecraft observations without near-simultaneous quasar-based calibrations. Solutions are presented for a global network of GPS receivers in which the formal errors in clock offset parameters are less than 0.5 ns. Comparisons of clock rate offsets derived from GPS measurements and from very long baseline interferometry and the examination of clock closure suggest that these formal errors are a realistic measure of GPS-based clock offset precision and accuracy. Incorporating GPS-based clock synchronization measurements into a spacecraft differential ranging system would allow tracking without near-simultaneous quasar observations. The impact on individual spacecraft navigation error sources due to elimination of quasar-based calibrations is presented. System implementation, including calibration of station electronic delays, is discussed. Author

N92-33358*# Naval Observatory, Washington, DC. Time Service Dept.
LORAN-C DATA REDUCTION AT THE US NAVAL OBSERVATORY **c04**
Harold Chadsey *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 103-11 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

As part of its mission and in cooperation with the U.S. Coast Guard, the U.S. Naval Observatory (USNO) monitors and reports the timing of the LORAN-C chains. The procedures for monitoring and processing the reported values have evolved with advances in monitoring equipment, computer interfaces and PCs. This paper discusses the current standardized procedures used by USNO to sort the raw data according to Group Repetition Interval (GRI) rate, to fit and smooth the data points, and, for chains remotely monitored, to tie the values to the USNO Master Clock. The results of these procedures are the LORAN time of transmission values, as references to UTC(USNO) (Universal Coordinated Time) for all LORAN chains. This information is available to users via USNO publications and the USNO Automated Data Service (ADS). Author

N92-33359*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE ROLE OF CLOCKS IN OPERATING DEEP SPACE MISSIONS
Sami W. Asmar and E. R. Kursinski *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 111-11 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

Operation of deep space missions requires stable frequency references and clocks to perform several mission critical functions. These references are used in generating the telecommunication links to maintain communications between earth and spacecraft, in generating accurate doppler, range, and very long baseline interferometry (VLBI) observables for determining the spacecraft's time varying position, and to generate on-board timing information for clocking out timed commands and time tagging instrument data. In addition, science applications exist, particularly those utilizing radio instrumentation, which can require additional functions and levels of performance. The design necessary to support these functions affects both the spacecraft and the ground tracking stations. Author

N92-33360*# Los Alamos National Lab., NM.
TIMING SYSTEM FOR FIRING WIDELY SPACED TEST NUCLEAR DETONATIONS
Ralph E. Partridge *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 119-12 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The national weapons design laboratories (Los Alamos National Laboratory and Lawrence Livermore National Laboratory) test fire nuclear devices at the Nevada Test Site (NTS), which is spread over an area of over 1200 square miles. On each test there are hundreds of high time resolution recordings made of nuclear output waveforms and other phenomena. In order to synchronize these recordings with each other, with the nuclear device, and with offsite recordings, there is a requirement that the permanent command center and the outlying temporary firing sites be time tied to each other and to UTC to permit firing the shot at a predetermined time with an accuracy of about a microsecond. Various aspects of the test setup and timing system are discussed. Author

N92-33361*# Naval Space Surveillance System, Dahlgren, VA.
NAVAL SPACE SURVEILLANCE CENTER USES OF TIME, FREQUENCY, AND PHASE
Carroll C. Hayden and Stephen H. Knowles *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 127-13 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The Naval Space Surveillance Center (NAVSPASUR) is an operational naval command that has the mission of determining the location of all manmade objects in space and transmitting information on objects of interest to the fleet. NAVSPASUR operates a 217 MHz radar fence that has 9 transmitting and receiving stations deployed in a line across southern Continental United States (CONUS). This surveillance fence provides unalerted detection of satellites overflying CONUS. NAVSPASUR also maintains a space catalog of all orbiting space objects. NAVSPASUR plays an important role as operational alternate to the primary national Space Surveillance Center (SSC) and Space Defence Operations Center (SPADOC). In executing these responsibilities, NAVSPASUR needs precise and/or standardized time and frequency in a number of applications. These include maintenance of the radar fence references to specification, and

coordination with other commands and agencies for data receipt and dissemination. Precise time and frequency must be maintained within each site to enable proper operation of the interferometry phasing technique used. Precise time-of-day clocking must exist between sites for proper intersite coordination. Phase may be considered a derivative of time and frequency. Its control within each transmitter or receiver site is of great importance to NAVSPASUR because of the operation of the sensor as an interferometer system, with source direction angles as the primary observable. Determination of the angular position of a satellite is directly dependent on the accuracy with which the differential phase between spaced subarrays can be measured at each receiver site. Various aspects of the NAVSPASUR are discussed with respect to time, frequency, and phase. Author

N92-33362*# Idaho Univ., Moscow. Dept. of Electrical Engineering.
PRECISE TIME AND TIME INTERVAL APPLICATIONS TO ELECTRIC POWER SYSTEMS
Robert E. Wilson *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 133-14 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

There are many applications of precise time and time interval (frequency) in operating modern electric power systems. Many generators and customer loads are operated in parallel. The reliable transfer of electrical power to the consumer partly depends on measuring power system frequency consistently in many locations. The internal oscillators in the widely dispersed frequency measuring units must be syntonized. Elaborate protection and control systems guard the high voltage equipment from short and open circuits. For the highest reliability of electric service, engineers need to study all control system operations. Precise timekeeping networks aid in the analysis of power system operations by synchronizing the clocks on recording instruments. Utility engineers want to reproduce events that caused loss of service to customers. Precise timekeeping networks can synchronize protective relay test-sets. For dependable electrical service, all generators and large motors must remain close to speed synchronism. The stable response of a power system to perturbations is critical to continuity of electrical service. Research shows that measurement of the power system state vector can aid in the monitoring and control of system stability. If power system operators know that a lightning storm is approaching a critical transmission line or transformer, they can modify operating strategies. Knowledge of the location of a short circuit fault can speed the re-energizing of a transmission line. One fault location technique requires clocks synchronized to one microsecond. Current research seeks to find out if one microsecond timekeeping can aid and improve power system control and operation. Author

N92-33363*# Bonneville Power Administration, Vancouver, WA. Div. of Labs.
PRECISE TIME DISSEMINATION AND APPLICATIONS DEVELOPMENT ON THE BONNEVILLE POWER ADMINISTRATION SYSTEM
Ken E. Martin and J. Esztergalyos *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 147-16 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The Bonneville Power Administration (BPA) uses IRIG-B transmitted over microwave as its primary system time dissemination. Problems with accuracy and reliability have led to ongoing research into better methods. BPA has also developed and deployed a unique fault locator which uses precise clocks synchronized by a pulse over microwaves. It automatically transmits the data to a central computer for analysis. A proposed system could combine fault location timing and time dissemination into a Global Position System (GPS) timing receiver and close the verification loop through a master station at the Dittmer Control Center. Such a system would have many advantages, including lower cost, higher reliability, and wider industry support. Test results indicate the GPS has sufficient accuracy and reliability for this and other current timing requirements including synchronous phase angle measurements. A phasor measurement system which provides phase angle has recently been tested with excellent results. Phase angle is a key parameter in power system control applications including dynamic braking, DC modulation, remedial action schemes, and system state estimation. Further research is required to determine the applications which can most effectively use real-time phase angle measurements and the best method to apply them. Author

N92-33364*# Shanghai Observatory (China).
A HYDROGEN MASER WITH CAVITY AUTO-TUNER FOR TIMEKEEPING **c36**
C. F. Lin, J. W. He, and Z. C. Zhai *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 161-16 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

A hydrogen maser frequency standard for timekeeping was worked on at the Shanghai Observatory. The maser employs a fast cavity auto-tuner, which can detect and compensate the frequency drift of the high-Q resonant cavity with a short time constant by means of a signal injection method, so that the long term frequency stability of the maser standard is greatly improved. The cavity auto-tuning system and some maser data obtained from the atomic time comparison are described. Author

N92-33365*# Shanghai Observatory (China).
A KIND OF SMALL HYDROGEN MASER FOR TIME-KEEPING **c36**
Z. C. Zhai, C. F. Lin, J. W. He, H. X. Huang, and J. F. Lu *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 169-17 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

A kind of small hydrogen maser standard for timekeeping is being developed at Shanghai Observatory. The maser employs a cylindrical capacitively loaded cavity construction, resulting in significant size and weight reduction compared to a traditional hydrogen maser. The Q of the compact cavity is electronically enhanced by a suitable positive feedback into the cavity to enable sustained maser oscillation. The long-term stability of the maser is improved by a cavity frequency stabilization servo-system. The design and development of the maser, as well as photographs of the new maser system during the construction phase are described. Author

N92-33366*# Parzen (Benjamin), San Diego, CA.
UNIVERSAL, COMPUTER FACILITATED, STEADY STATE OSCILLATOR, CLOSED LOOP ANALYSIS THEORY AND SOME APPLICATIONS TO PRECISION OSCILLATORS **c33**
Benjamin Parzen *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 177-18 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The theory of oscillator analysis in the immittance domain should be read in conjunction with the additional theory presented here. The combined theory enables the computer simulation of the steady state oscillator. The simulation makes the calculation of the oscillator total steady state performance practical, including noise at all oscillator locations. Some specific precision oscillators are analyzed. Author

N92-33367*# Ball Corp., Irvine, CA. Efratom Div.
MEASUREMENT OF PRECISION OSCILLATOR PHASE NOISE USING THE TWO-OSCILLATOR COHERENT DOWN-CONVERSION TECHNIQUE **c33**
Christopher J. Pagnanelli and William F. Cashin *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time

and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 189-20 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The characterization of precision frequency standard phase noise and spurious outputs is addressed, using the two-oscillator coherent downconversion technique. Focus is on techniques for making accurate measurements of phase noise and spurious outputs within 100 KHz of a carrier. Significant sources of measurement error related to hardware design problems and inadequate measurement procedures are discussed: measurement errors resulting from system noise sources, phase-locked loop effects, and system bandwidth limitations. In addition, methods and design considerations for minimizing the effects of such errors are presented. Analytic discussions and results are supplemented with actual test data and measurements made using measurement hardware developed at the Ball Corporation, Efratom Division.
Author

N92-33368*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN IMPROVED OFFSET GENERATOR DEVELOPED FOR ALLAN DEVIATION MEASUREMENT OF ULTRA STABLE FREQUENCY STANDARDS
Robert L. Hamell, Paul F. Kuhnle, and Richard L. Sydnor *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 209-21 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

Measuring the performance of ultra stable frequency standards such as the Superconducting Cavity Maser Oscillator (SCMO) necessitates improvement of some test instrumentation. The frequency stability test equipment used at JPL includes a 1 Hz Offset Generator to generate a beat frequency between a pair of 100 MHz signals that are being compared. The noise floor of the measurement system using the current Offset Generator is adequate to characterize stability of hydrogen masers, but it is not adequate for the SCMO. A new Offset Generator with improved stability was designed and tested at JPL. With this Offset Generator and a new Zero Crossing Detector, recently developed at JPL, the measurement flow was reduced by a factor of 5.5 at 1 second tau, 3.0 at 1000 seconds, and 9.4 at 10,000 seconds, compared against the previous design. In addition to the new circuit designs of the Offset Generator and Zero Crossing Detector, tighter control of the measurement equipment environment was required to achieve this improvement. The design of this new Offset Generator are described, along with details of the environment control methods used.
Author

N92-33369*# Beijing Inst. of Radio Metrology and Measurements (China).
THE MEASUREMENT SYSTEM OF PULSE MODULATED CARRIER FREQUENCY STABILITY AND TIMING JITTER
Cheng-Fu Li *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 219-22 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The definition of pulse modulated carrier frequency stability and timing jitter as well as the configuration and synchronous acquisition measurement method of its measurement system are described. Frequency stability of the pulse modulated carrier is measured with a discrimination technique. The pulse modulated carrier under testing is mixed with a reference frequency synthesizer. A delay line is used to convert the frequency fluctuation mixed IF signal to the voltage fluctuation. The system has the capability to make the phase noise measurement of two port devices on a pulsed carrier using a phase bridge. The noise voltage mentioned above is applied to the data acquisition and processing unit by PC to realize stability measurement. The data acquisition is in the form of pulse synchronization so that the measurement system accuracy is increased. The pulse width is more than 0.3 microseconds. The phase fluctuation variance, sigma, is less than 0.017. The time interval measuring system with high resolution is used to make interpulse timing and pulse width jitters automatic measurement. The pulse width is less than 0.2 ns. The resolution is 0.1 ns. The system is successfully applied to radar measurement.
Author

N92-33370*# Air Force Systems Command, Norton AFB, CA. Space Systems Div.
MEASURING FREQUENCY CHANGES DUE TO MICROWAVE POWER VARIATIONS AS A FUNCTION OF C-FIELD SETTING IN A RUBIDIUM FREQUENCY STANDARD
E. B. Sarosy, Walter A. Johnson (Aerospace Corp., El Segundo, CA.), Sarunas K. Karuza (Aerospace Corp., El Segundo, CA.), and Frank J. Voit (Aerospace Corp., El Segundo, CA.) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 229-23 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

It has been shown in previous studies that in some cesium frequency standards there exist certain C-field settings that minimize frequency changes that are due to variations in the microwave power. In order to determine whether similar results could be obtained with rubidium (Rb) frequency standards (clocks), we performed a similar study, using a completely automated measurement system, on a commercial Rb standard. From our measurements we found that changing the microwave power to the filter cell resulted in significant changes in frequency, and that the magnitude of these frequency changes at low C-field levels went to zero and decreased as the C-field was increased.
Author

N92-33371*# Aerospace Corp., El Segundo, CA. Electronics Technology Center.
DEVELOPMENT OF AN OPTICALLY-PUMPED CESIUM STANDARD AT THE AEROSPACE CORPORATION
Yat C. Chan *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 237-24 (For primary document see N92-33350 24-70)
(Contract F04701-88-C-0089)
Avail: CASI HC A02/MF A04

We have initiated a research program to study the performance of compact optically-pumped cesium (Cs) frequency standards, which have potential for future timekeeping applications in space. A Cs beam clock apparatus has been assembled. Basic functions of the frequency standard have been demonstrated. Clock signals are observed with optical pumping schemes using one or two lasers. With two laser pumping, we are able to selectively place up to 80 percent of the atomic population into one of the clock transition states. The observed pattern of clock signal indicates that the velocity distribution of the Cs atoms contributing to the microwave signal is beam-Maxwellian. Thus, in the optically-pumped Cs frequency standards, the entire Cs population in the atomic beam could be utilized to generate the clock signals. This is in contrast to the conventional Cs beam standards where only approx. 1 percent of the atoms in the beam are used. More efficient Cs consumption can lead to improved reliability and increased useful lifetime of the clock.
Author

N92-33372*# Naval Research Lab., Washington, DC.
A NEW TWO-WAY TIME TRANSFER MODEM
G. Paul Landis, I. J. Galysh, Guy A. Gifford, and Allen Osborne, III (Osborne, Allen Associates, Westlake Village, CA) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 247-25 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The use of commercial communication satellites for precise time transfer has been performed with a variety of techniques for a number of years. Military communications systems can also provide this function in a few deployed systems. A new design is

demonstrated of a time transfer modem that can be produced at a reasonable cost and enable users to make direct comparisons with the Naval Observatory with nanosecond precision. A flexible all-digital design is being implemented that will enable a variety of different codes to be employed. The design and operating modes of this equipment are demonstrated. Author

N92-33373*# Deines (Steven D.), Colorado Sprongs, CO.
NONINERTIAL COORDINATE TIME: A NEW CONCEPT AFFECTING TIME STANDARDS, TIME TRANSFERS, AND CLOCK SYNCHRONIZATION
Steven D. Deines *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 259-26 (For primary document see N92-33350 24-70)
Avail: CASI HC A01/MF A04

Relativity compensations must be made in precise and accurate measurements whenever an observer is accelerated. Although many believe the Earth-centered frame is sufficiently inertial, accelerations of the Earth, as evidenced by the tides, prove that it is technically a noninertial system for even an Earth-based observer. Using the constant speed of light, a set of fixed remote clocks in an inertial frame can be synchronized to a fixed master clock transmitting its time in that frame. The time on the remote clock defines the coordinate time at that coordinate position. However, the synchronization procedure for an accelerated frame is affected, because the distance between the master and remote clocks is altered due to the acceleration of the remote clock toward or away from the master clock during the transmission interval. An exact metric that converts observations from noninertial frames to inertial frames was recently derived. Using this metric with other physical relationships, a new concept of noninertial coordinate time is defined. This noninertial coordinate time includes all relativity compensations. This new issue raises several timekeeping issues, such as proper time standards, time transfer process, and clock synchronization, all in a noninertial frame such as Earth. Author

N92-33374*# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Itlay).
CHARACTERIZATION OF FREQUENCY STANDARD INSTABILITY BY ESTIMATION OF THEIR COVARIANCE MATRIX
Patrizia P. Travella and Amedeo Premoli (Trieste Univ., Italy) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 265-27 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The popular three-cornered hat method used for evaluating the noise contribution of individual frequency standards is examined. In this method, the results are sometimes not consistent because one or more clock variances turn out to be negative. Different causes for this have been conjectured: among them one regards the hypothesis of uncorrelated clocks, essential in this method. An entirely revised version of the three-cornered hat method is proposed which permits evaluation of the individual variances, and also the possible covariances between clocks. The lack of uncorrelation calls for a more general mathematical model leading to an undetermined linear system. Examples of frequency instability measurements processed by the classical three-cornered hat method and this method are presented showing that the solutions are identical only when the uncorrelation hypothesis doesn't violate the positive definiteness of R. Author

N92-33375*# Beijing Inst. of Radio Metrology and Measurements (China).
COMPACT MICROWAVE CAVITY FOR HYDROGEN ATOMIC CLOCK
Dejun Zhang, Yan Zhang, Yigen Fu, and Yanjun Zhang *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 277-28 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

A summary is presented that introduces the compact microwave cavity used in the hydrogen atomic clock. Special emphasis is placed on derivation of theoretical calculating equations of main parameters of the microwave cavity. A brief description is given of several methods for discriminating the oscillating modes. Experimental data and respective calculated values are also presented. Author

N92-33376*# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
A CORRELATIONAL ANALYSIS OF THE EFFECTS OF CHANGING ENVIRONMENTAL CONDITIONS ON THE NR ATOMIC HYDROGEN MASER **c36**
Richard A. Dragonette and Joseph J. Suter *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 287-29 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

An extensive statistical analysis has been undertaken to determine if a correlation exists between changes in an NR atomic hydrogen maser's frequency offset and changes in environmental conditions. Correlation analyses have been performed comparing barometric pressure, humidity, and temperature with maser frequency offset as a function of time for periods ranging from 5.5 to 17 days. Semipartial correlation coefficients as large as -0.9 have been found between barometric pressure and maser frequency offset. Correlation between maser frequency offset and humidity was small compared to barometric pressure and unpredictable. Analysis of temperature data indicates that in the most current design, temperature does not significantly affect maser frequency offset. Author

N92-33377*# Naval Observatory, Washington, DC. Time Service Dept.
TIMESCALE ALGORITHMS COMBINING CESIUM CLOCKS AND HYDROGEN MASERS
Lee A. Breakiron *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 297-30 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The United States Naval Observatory (USNO) atomic timescale, formerly based on an ensemble of cesium clocks, is now produced by an ensemble of cesium clocks and hydrogen masers. In order to optimize stability and reliability, equal clock weighting has been replaced by a procedure reflecting the relative, time-varying noise characteristics of the two different types of clocks. Correlation of frequency drift is required, and residual drift is avoided by the eventual complete deweighting of the masers. Author

N92-33378*# Naval Research Lab., Washington, DC.
FREQUENCY STABILITY OF GPS NAVSTAR BLOCK 1 AND BLOCK 2 ON-ORBIT CLOCKS
Thomas B. McCaskill, Wilson G. Reid, James A. Buisson, and Hugh E. Warren (Sachs/Freeman Associates, Inc., Landover, MD.) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 307-31 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

Analysis of the frequency stability of the on-orbit NAVSTAR clocks os performed by the Naval Research Laboratory. The frequency stability is presented for sample times of one day to 30 days. Composite frequency stability profiles are presented for Block 1 and Block 2 NAVSTAR clocks. Several NAVSTAR cesium clocks show frequency stabilities of a few parts in 1 x 10(exp 14) for long sample times. Time-domain noise-process analysis shows the dominant noise type to be white frequency noise for sample times of one to ten days. The non-stationary stochastic behavior of one of the cesium clocks, illustrated by its frequency stability history,

shows that the frequency stability is not always time-invariant.
Author

N92-33379*# National Inst. of Standards and Technology, Boulder, CO.
THE ROLE OF THE CONSULTATIVE COMMITTEE ON INTERNATIONAL RADIO (CCIR) IN TIME AND FREQUENCY **c32**
Roger East Beehler *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 321-33 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The Consultative Committee on International Radio (CCIR) is a technical advisory group that, within the International Telecommunications Union (ITU), provides formal recommendations, technical advice, and technical information related to the allocation and use of the radio spectrum. The CCIR does its work through a number of separate study groups, each of which deals primarily with one or more radio based services recognized by the ITU. One of these, Study Group 7, is called 'Science Services' and deals with, among other things, time and frequency services, and related topics. This part of CCIR is probably best known for its development and implementation of the UTC time system in 1972. The U.S. National Administration develops proposed recommendations and provides other technical input to the CCIR through an organization of U.S. Study Groups that parallel those functioning internationally. Both the private and government sectors participate actively under the general oversight of the U.S. State Department and its U.S. CCIR National Committee. Current and projected future activities of U.S. and international Study Group 7 are described, including some examples of current recommendations, handbooks, and other documentation that might be useful for working with time and frequency applications.
Author

N92-33380*# Bureau International des Poids et Mesures, Sevres (France).
ACCURACY OF GPS TIME TRANSFER VERIFIED BY CLOSURE AROUND THE WORLD
Wlodimierz W. Lewandowski, Gerard Petit, and Claudine Thomas *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 331-33 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The precision of time transfer over intercontinental distances by the Global Positioning System common-view method, using measurements of ionospheric delays, precise ephemerides provided by the Defense Mapping Agency (DMA) and a consistent set of antenna coordinates, reaches 3 to 4 ns for a single 13-minute measurement, and decreases to 2 ns when averaging several measurements over the period of one day. It is thought that even this level of precision can be bettered by improving the ionospheric measurements, the ephemerides of satellites, and the antenna coordinates. In the same conditions, an estimation of the accuracy is attained by using three intercontinental links encircling the Earth to establish a closure condition; the three independent links should add to zero. We have computed such a closure condition over a period of 13 months using data recorded at the Paris Observatory, at the Communications Research Laboratory in Tokyo, and at the National Institute for Standards and Technology in Boulder, Colorado. The closure condition is verified to within a few nanoseconds, but a bias, varying with time, can be detected.
Author

N92-33381*# Leeds Univ. (England). Dept. of Electronic and Electrical Engineering.
COMPARISON OF GLONASS AND GPS TIME TRANSFERS BETWEEN TWO WEST EUROPEAN TIME LABORATORIES AND VNIIFTRI **c04**
P. Daly, N. B. Koshelyaevsky (Vsesoyuznyi Nauchno-Issledovatelskii Inst. Radiatsionnoi Tekhniki, Moscow, USSR), Wlodzimierz Lewandowski (Bureau International des Poids et Mesures, Sevres, France), Gerard Petit (Bureau International des Poids et Mesures, Sevres, France), and Claudine Thomas (Bureau International des Poids et Mesures, Sevres, France) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 341-35 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

The University of Leeds built a Global Positioning System/Global Orbiting Navigation Satellite System (GPS/GLONASS) receiver about five years ago and since then has provided continuous information about GLONASS time and its comparison with GPS time. For the last two years, VNIIFTRI (All Union Institute for Physical, Technical and Radiotechnical Measurements) and some other Soviet time laboratories have used Soviet built GLONASS navigation receivers for time comparisons. Since June 1991, VNIIFTIR has been operating a GPS time receiver on loan from the BIPM (Bureau International des Poids et Mesures). This offered, for the first time, an opportunity for direct comparison of time transfers using GPS and GLONASS. This experiment shows that even with relatively imprecise data recording and processing, in terms of time metrology, GLONASS can provide continental time transfer at a level of several tens of nanoseconds.
Author

N92-33382*# Australian Capital Territory.
A PROPOSED TIME TRANSFER EXPERIMENT BETWEEN THE USA AND THE SOUTH PACIFIC
John Luck, John Dunkley (Defence Science and Technology Organization, Salisbury, Australia), Tim Armstrong (Department of Scientific and Industrial Research, Lower Hutt, New Zealand), Guy A. Gifford (Department of Defense, Washington, DC.), Paul Landis (Department of Defense, Washington, DC.), Scott Rasmussen (Department of Defense, Washington, DC.), Paul J. Wheeler (Department of Defense, Washington, DC.), Thomas R. Bartholomew (Analytic Sciences Corp., Linthicum, MD.), and Samuel R. Stein (Timing Solutions Corp., Boulder, CO.) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 351-36 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

Described here are the concept, architecture and preliminary details of an experiment directed towards providing continuous Ultra High Precision (UHP) time transfer between Washington, DC; Salisbury, SA Australia; Orroral Valley, ACT Australia; and Lower Hutt, New Zealand. A proposed method of distributing UTC(USNO) at a high level of precision to passive users over a broad area of the South Pacific is described. The concept is based on active two-way satellite time transfer from the United States Naval Observatory (USNO) to the proposed USNO Master Clock West (MCW) in Wahiwa, HI at the 1 nanosecond level using active satellite two-way time transfer augmented by Precise Positioning Service (PPS) of the Global Positioning System (GPS). MCW would act as an intermediate transfer/reference station, again linked to Salisbury at the 1 nanosecond level using active satellite two-way time transfer augmented by PPS GPS. From this point, time would be distributed within the region by two methods. The first is an existing TV line sync system using an Australian communications satellite (AUSSAT K1) which is useful to the 20 nanosecond level. The second approach is RF ranging and multilateration between Salisbury, Orroral Observatory, Lower Hutt and the AUSSAT B1 and B2 to be launched in 1992. Orroral Observatory will provide precise laser ranging to the AUSSAT B1/B2 retro reflectors which will reduce ephemeris related time transfer errors to below 1 nanosecond. The corrected position will be transmitted by both the time transfer modem and the existing TV line sync dissemination process. Multilateration has the advantage of being an all weather approach and when used with the laser ranging technique will provide a precise measurement of the propagation path delays. This will result in time transfer performance levels on the order of 10 nanoseconds to passive users in both Australia and New Zealand.
Author

N92-33383*# National Research Council of Canada, Ottawa (Ontario). Inst. for National Measurement Standards.
GEOSTATIONARY SATELLITE POSITION DETERMINATION FOR COMMON-VIEW TWO-WAY TIME TRANSFER MEASUREMENTS
Qixiang Zhuang and Robert J. Douglas *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 365-37 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

In common-view two-way time transfer, each earth station receives an unwanted return signal from its own transmission as well as the desired signal from the other earth station. National Institute of Standards and Technology (NIST), the National Research Council (NRC), and the U.S. Naval Observatory (USNO) have been cooperating in a three-corner common-view two-way time transfer experiment. Some systematic effects are known to depend on the position of the satellite (Sagnac effect and the cross-correlation pulling of the pseudo-random codes). A method is presented for deriving accurate satellite ranges from each of three stations doing common-view two-way satellite time transfer measurements, when one (and only one) station also takes ranging measurements on its 'unwanted return signal' for a brief period. The method is applied to determine the variations in position of the satellite used over the course of the NIST/NRC/USNO SBS-3 experiment, with ranging data taken at NRC, where no additional hardware was required to automate the process. The fit and extrapolation which are employed in this method have an estimated precision of 2 m. If the delays of SBS-3 satellite KU band transponder and earth station equipment were measured accurately as well as the tropospheric refractions were well modeled and corrected, we would expect a ranging accuracy of 2.5 m and satellite positioning accuracy would be 200 m (latitude) 50 m (longitude) and 20 m (height above ellipsoid). Author

N92-33384*# Ministry of Posts and Telecommunications, Ibaraki (Japan). Communications Research Lab.
MILLISECOND PULSAR OBSERVATION SYSTEM AT CRL
Yuko Hanado, H. Kiuchi, S. Hama, A. Kaneko, and M. Imae *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 377-38 (For primary document see N92-33350 24-70)
Avail: CASI HC A02/MF A04

Millisecond pulsars have attracted attention as future reference clocks in place of present atomic clocks. The Communications Research Laboratory (CRL) has been developing an observation system to measure the pulse timing of a millisecond pulsar precisely, and has recently completed the basic part of the task. We observed PSR1937+21 at 1.5GHz band and got a pulse timing with a precision of 16 micro sec/tau by five days of observation. Author

N92-33385*# Cantonal Observatory, Neuchatel (Switzerland).
IN ORBIT DEMONSTRATION OF A H-MASER CLOCK SYSTEM
Giovanni Busca, Laurent-Guy Bernier, Siegfried K. Starker (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, Germany, F.R.), and S. Feltham (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 385-39 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The ESA/NASA technology demonstration flight of a pair of hydrogen masers on the EURECA 3 mission is planned for 1998. The ESA part of the experiment will have a maser built by Neuchatel Observatory and a microwave time and frequency transfer system derived from the existing Precise Range and Range Rate Equipment (PRARE) system. The NASA part of the experiment will have a maser built by the Smithsonian Astrophysical Observatory and a laser time transfer system. The technology demonstration experiment is described with its expected outcomes and applications. Author

N92-33386*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
TEST OF AN ORBITING HYDROGEN MASER CLOCK SYSTEM USING LASER TIME TRANSFER
Robert F. C. Vessot (Smithsonian Astrophysical Observatory, Cambridge, MA.), Edward M. Mattison (Smithsonian Astrophysical Observatory, Cambridge, MA.), G. U. Nystrom (Smithsonian Astrophysical Observatory, Cambridge, MA.), and Rudolph Decher *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 401-41 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

We describe a joint Smithsonian Astrophysical Laboratory/National Aeronautics and Space Administration (SAO/NASA) program for flight testing a atomic hydrogen maser clock system designed for long-term operation in space. The clock system will be carried by a shuttle-launched EURECA spacecraft. Comparisons with earth clocks to measure the clock's long-term frequency stability (tau = 10(exp 4) seconds) will be made using laser time transfer from existing NASA laser tracking stations. We describe the design of the maser clock and its control systems, and the laser timing technique. We describe the precision of station time synchronization and the limitations in the comparison between the earth and space time scales owing to gravitational and relativistic effects. We will explore the implications of determining the spacecraft's location by an on-board Global Position System (GPS) receiver, and of using microwave techniques for time and frequency transfer. Author

N92-33387*# Air Force Geophysics Lab., Hanscom AFB, MA. Ionospheric Physics Div.
PRESENT STATUS AND FUTURE PROSPECTS FOR IONOSPHERIC PROPAGATION CORRECTIONS FOR PRECISE TIME TRANSFER USING GPS
John A. Klobuchar *In* NASA. Goddard Space Flight Center, Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting Jul. 1992 p 417-42 (For primary document see N92-33350 24-70)
Avail: CASI HC A03/MF A04

The ionosphere can be the greatest variable source of error in precise time transfer using Global Positioning System (GPS) satellites. For single frequency GPS users, the ionospheric correction algorithm can provide an approximate 50 percent r.m.s. correction to the time delay, but users who desire a more complete correction must make actual measurements of ionospheric time delay along the path to the GPS satellite. Fortunately, at least three commercial GPS receivers, specifically designed to measure and correct for ionospheric time delay, are now, or soon will be, available. Initial operation with two different types of GPS ionospheric receivers demonstrated a high degree of accuracy in measuring the ionospheric group delay. Results of these measurements are presented. For those who use a model to correct for ionospheric time delay, it is tempting to use daily values of solar 10.7 cm radio flux to correct a monthly average ionospheric time delay model for each day's operation. The results of correlation of daily maximum ionospheric time delay against solar radio flux values show a poor correlation will be obtained by this procedure. Prospects for improving ionospheric corrections during the declining phase of the present solar cycle are discussed. Author

N92-33402# California Univ., Los Angeles.
APPLICATIONS OF MESOSCOPIC PHYSICS
Shechao Feng 1992 5 p
(Contract DE-FG03-88ER-45378)
(DE92-015610; DOE/ER-45378/T1) Avail: CASI HC A01/MF A01

This report discusses the following topics: acoustical nondestructive evaluation of heterogeneous materials in the multiple scattering regime; classical and quantum superdiffusion

in a time-dependent random potential; negative magnetoresistance in variable range hopping conduction; reproducible conductance fluctuations in macroscopic Anderson insulators; and feasibility of far-infrared lasers using multiple semiconductor quantum wells.
DOE

N92-33562# Naval Postgraduate School, Monterey, CA.
OBSERVATIONS OF BREATHER SOLITONS IN A NONLINEAR VIBRATORY LATTICE M.S. Thesis
Mary L. Atchley Mar. 1992 84 p
(AD-A252936) Avail: CASI HC A05/MF A01

Experimental, numerical and analytical investigations of steady-state upper cutoff breather solitons in a one-dimensional lattice of coupled nonlinear oscillators are reported. These states are self-localized standing wave structures that can be considered as amplitude modulations of the upper cutoff mode, in which each oscillator is 180 deg out of phase with its immediate neighbors. The observation of the upper cutoff solitons: lower cutoff breathers, and lower and upper cutoff kinks. The experimental system is a lattice of magnetically coupled pendulums that is oscillated vertically. Numerical simulations are made in a lattice that approximately models the actual lattice. The structures are analytically described by a solution to a nonlinear Schrodinger equation supplemented with zero and second harmonics. The harmonic terms produce an antisymmetry in the breather amplitude profile that is noticeable in the experimental data and can be extreme in the numerical simulations. GRA

N92-33705# Pittsburgh Univ., PA.
THE RELATIONSHIP BETWEEN MICROSTRUCTURE AND MAGNETIC PROPERTIES IN HIGH-ENERGY PERMANENT MAGNETS CHARACTERIZED BY POLYTWINNED STRUCTURES
1992 49 p
(Contract DE-FG02-89ER-45390)
(DE92-015198; DOE/ER-45390/3) Avail: CASI HC A03/MF A01

This report summarizes the results of a study of the relationship between microstructure and magnetic properties in a unique genre of ferromagnetic material characterized by a polysynthetically twinned structure which arises during solid state transformation. These results stem from the work over a period of approximately 27 months of a nominal 3 year grant period. The report also contains a proposal to extend the research project for an additional 3 years. The polytwinned structures produce an inhomogeneous magnetic medium in which the easy axis of magnetization varies quasi-periodically giving rise to special domain configurations which are expected to markedly influence the mechanism of magnetization reversal and hysteresis behavior of these materials in bulk or thin films. The extraordinary permanent magnet properties exhibited by the well-known Co-Pt alloys as well as the Fe-Pt and Fe-Pd systems near the equiatomic composition derive from the formation of a polytwinned microstructure. DOE

N92-34093# Rochester Univ., NY.
BEHAVIORAL EFFECTS OF ELECTRIC AND MAGNETIC FIELDS
V. G. Laties 1 Apr. 1992 10 p
(Contract DE-AC02-85CE-76254)
(DE92-014968; DOE/CE-76254/10) Avail: CASI HC A02/MF A01

Two sets of behavioral studies were conducted. In the first, three procedures were used to determine how aversive a 100 kV/m 60-Hz electric field is for a rat. Each of the procedures enabled rats to respond in order to reduce exposure to the field. The rats did reduce exposure slightly with one, but not with the other two, whereas they reduced their exposure to moderate illumination in all three procedures. The results show that while the procedures were appropriate for assessing stimulus aversiveness, 100 kV/m is not a generally aversive stimulus for the rat. It was previously reported that immediately after exposure for 30 minutes to a horizontal 60-Hz, 5 x 10(exp -5)T field combined with a total static field of 2.61 x 10(exp -5)T, the rate of lever pressing by rats increased during the DRL component of a multiple fixed ratio, DRL schedule of food reinforcement. This project failed to confirm those observations in an experiment that duplicated the behavioral baseline and the magnetic field exposure conditions, with the exception that the total DC vector was greater in these experiments than it was in others. DOE

N92-33875*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE PEKERIS PROBLEM, AND THE INTERIOR OF THE PULSATING SPHERE, FIRST SUCCESS OF EXACT RAY THEORY, AND WHAT RAYS?
Gerry L. McAninch *In its* High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 1-5 (For primary document see N92-33874 24-05)
Avail: CASI HC A01/MF A03

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N92-33283# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THE SMALL-SLOPE APPROXIMATION FOR MONOSTATIC SCATTERING
David H. Berman 9 Jun. 1992 15 p
(Contract N00014-89-J-2042)
(AD-A253065) Avail: CASI HC A03/MF A01

By using a variational principle for scattering by rough interfaces, the functional derivative of the scattered part of an acoustic field originating from a point source is derived directly in the time domain. This general result is specialized to the case of scattering by surfaces on which fields satisfy Dirichlet boundary conditions. It is shown that when the small-slope approximation is used for surface fields, a simple result can be obtained for monostatic scattering.
GRA

N92-33431# Wright State Univ., Dayton, OH. Dept. of Psychology.
PATTERN ANALYSIS BASED MODELS OF MASKING BY SPATIALLY SEPARATED SOUND SOURCES Annual Report, 15 May 1991 - 14 May 1992
Robert H. Gilkey 15 Jun. 1992 11 p
(Grant AF-AFOSR-0289-91)
(AD-A253036; AFOSR-92-0650TR) Avail: CASI HC A03/MF A01

One goal of this program is to examine masking among spatially separated sound sources. The results indicate that masking release on the order of 8-20 dB can be observed in free-field masking situations when the signal and the masker are spatially separated by 90 degrees. This magnitude of masking release is comparable to that observed in traditional binaural masking level difference experiments, where the stimuli are presented through headphones. However, while masking release observed in headphone studies is typically assumed to be based on interaural differences in phase or on interaural differences in intensity, we observed substantial masking release in the median plane where interaural differences are minimal. Our own headphone masking research is also questioning traditional models of binaural masking. Work is underway to develop a neural network based model of sound localization. The results of these studies will have implications for the development of virtual environments and auditory displays.
GRA

N92-33432# North Carolina Univ., Chapel Hill. Dept. of Surgery.
AUDITORY SPECTRO-TEMPORAL PATTERN ANALYSIS Annual Report, Dec. 1990 - 30 Nov. 1991
Joseph W. Hall 12 May 1992 8 p
(Grant AF-AFOSR-0108-90)

(AD-A253037; AFOSR-92-0651TR) Avail: CASI HC A02/MF A01

The long-term aim of this project is a better understanding of auditory processes which use across frequency or across-ear temporal envelope difference cues to aid performance. Specific areas of investigation include comodulation masking release (CMR), the masking-level difference (MLD), temporal resolution, and the processing of amplitude and frequency modulation. The goal of the first proposed experiment is to examine the possible relation between CMR and auditory phenomena related to auditory scene analysis; the goal of the second experiment is to examine the possible relation between CMR and the MLD for narrowband noise maskers; the goal of the third experiment is to determine the extent to which across-frequency correlation of temporal envelope may influence gap detection for wideband stimuli; the goal of the fourth experiment is to determine whether masking release can be derived from cues based upon across-frequency coherence of frequency modulation; and the goal of the fifth experiment is to examine a modulation masking phenomenon related to frequency modulation. The tasks will be signal detection in masking noise, temporal gap detection, and the detection of frequency modulation. Testing will be performed in a sound-treated room, using a 3AFC adaptive procedure. GRA

N92-33719*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

APPLICATION OF MAGNITUDE ESTIMATION SCALING TO THE ASSESSMENT OF SUBJECTIVE LOUDNESS RESPONSE TO SIMULATED SONIC BOOMS

S. McDaniel (James Madison Univ., Harrisonburg, VA.), J. D. Leatherwood, and B. M. Sullivan (Lockheed Engineering and Sciences Co., Hampton, VA.) Sep. 1992 33 p
(RTOP 537-03-21-03)
(NASA-TM-107657; NAS 1.15:107657) Avail: CASI HC A03/MF A01

A laboratory study was conducted for the following reasons: (1) to investigate the application of magnitude estimation scaling for evaluating the subjective loudness of sonic booms; and (2) to compare the relative merits of magnitude estimation and numerical category scaling for sonic boom loudness evaluation. The study was conducted in the NASA LeRC's sonic boom simulator and used a total of 80 test subjects (48 for magnitude estimation and 32 for numerical category scaling). Results demonstrated that magnitude estimation was a practical and effective method for quantifying subjective loudness of sonic booms. When using magnitude estimation, the subjects made valid and consistent ratio judgments of sonic boom loudness irrespective of the frequency of presentation of the standard stimulus. Presentation of the standard as every fourth stimulus was preferred by the subjects and is recommended as the standard presentation frequency to be used in future tests. Author

N92-34134 Southampton Univ. (England). Inst. of Sound and Vibration Research.

THE USE OF SHORT RANGE UNDERWATER ACOUSTICAL MEASUREMENTS TO ESTIMATE SOME PARAMETERS OF AN IDEALISED SEDIMENTARY LAYER

P. D. Ward and J. R. Nedwell Apr. 1992 153 p Original contains color illustrations
(ISVR-TR-206) Copyright Avail: Issuing Activity

A method of estimating the best fit of seabed parameters to information gained from a series of short range reflection measurements is explored experimentally. A small-scale experiment in a water tank containing a layer of clay was conducted in which the sediment-borne wave was detected (this is the one that is transmitted into the clay, reflected from the lower interface, and then transmitted back towards a waterborne receiver thus carrying with it information on the sound speeds and sediment thickness). Correlations were performed to compare the experimental results with estimates of the compressional and shear wave sound speed and thickness, of the clay. For one particular value of sound speed and thickness, a series of computer simulations each produced travel time loci as a function of source-receiver separation for an idealised geo-acoustic model. Theoretical travel times were correlated with the experimental data and the quality of fit between the two was determined. From all the values of sediment sound speed and thickness that were considered, each test produced only a few particular combinations that correlated particularly well with the experimental data. Hence these tests go some way towards determining whether or not a solution to the inverse modelling process is unique. Author

N92-34148*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

ADVANCED SUBSONIC TRANSPORT APPROACH NOISE: THE RELATIVE CONTRIBUTION OF AIRFRAME NOISE

William L. Willshire, Jr. and Donald P. Garber (Lockheed Engineering and Sciences Co., Hampton, VA.) Jun. 1992 37 p
(RTOP 537-03-21-04)
(NASA-TM-104112; NAS 1.15:104112) Avail: CASI HC A03/MF A01

With current engine technology, airframe noise is a contributing source for large commercial aircraft on approach, but not the major contributor. With the promise of much quieter jet engines with the planned new generation of high-by-pass turbofan engines, airframe noise has become a topic of interest in the advanced subsonic transport research program. The objective of this paper is to assess the contribution of airframe noise relative to the other aircraft noise sources on approach. The assessment will be made for a current technology large commercial transport aircraft and for an envisioned advanced technology aircraft. NASA's Aircraft Noise Prediction Program (ANOPP) will be used to make total aircraft noise predictions for these two aircraft types. Predicted noise levels and areas of noise contours will be used to determine the relative importance of the contributing approach noise sources. The actual set-up decks used to make the ANOPP runs for the two aircraft types are included in appendixes. Author

N92-33876*# Texas Univ., Austin. Applied Research Labs.

A NUMERICAL MODEL FOR SONIC BOOM PROPAGATION THROUGH AN INHOMOGENEOUS, WINDY ATMOSPHERE

Leick D. Robinson *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 7-30 (For primary document see N92-33874 24-05)
(Contracts N00039-88-C-0043; N00039-91-C-0082)
Avail: CASI HC A03/MF A03

N92-33877*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.

WAVE EQUATIONS AND COMPUTATIONAL MODELS FOR SONIC BOOM PROPAGATION THROUGH A TURBULENT ATMOSPHERE

Allan D. Pierce *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 31-48 (For primary document see N92-33874 24-05)
(Grant NAG1-947)
Avail: CASI HC A03/MF A03

N92-33878*# Pennsylvania State Univ., University Park.

SIMULATIONS OF SONIC BOOM RAY TUBE AREA FLUCTUATIONS FOR PROPAGATION THROUGH ATMOSPHERIC TURBULENCE INCLUDING CAUSTICS VIA A MONTE CARLO METHOD

Victor W. Sparrow and Allan D. Pierce *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 49-62 (For primary document see N92-33874 24-05)
(Grant NAG1-947)
Avail: CASI HC A03/MF A03

N92-33879*# Pennsylvania State Univ., University Park.

ANALYSIS OF SONIC BOOM DATA TO QUANTIFY DISTORTIONS OF SHOCK PROFILES

Thomas A. Gionfriddo *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 63-76 (For primary document see N92-33874 24-05)

(Grant NAG1-947)
Avail: CASI HC A03/MF A03

N92-33880*# Wyle Labs., Inc., Arlington, VA.
THE EFFECT OF TURBULENCE ON THE LOUDNESS OF MINIMIZED SONIC BOOM SIGNATURES
Kenneth J. Plotkin *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 77-95 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

N92-33881*# Texas Univ., Austin. Applied Research Labs. and Mechanical Engineering Dept.
MODEL EXPERIMENT TO STUDY THE EFFECT OF TURBULENCE ON RISETIME AND WAVEFORM OF N WAVES
Bart Lipkens and David T. Blackstock *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 97-107 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

N92-33882*# Mississippi Univ., University. Dept. of Physics and Astronomy.
STEADY STATE RISETIMES OF SHOCK WAVES IN THE ATMOSPHERE
Richard Raspet, Henry Bass, Lixin Yao, and Wenliang Wu *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 109-115 (For primary document see N92-33874 24-05)
Avail: CASI HC A02/MF A03

N92-33883*# Air Force Systems Command, Wright-Patterson AFB, OH.
LATERAL SPREAD OF SONIC BOOM MEASUREMENTS FROM US AIR FORCE BOOMFILE FLIGHT TESTS
J. Micah Downing *In* NASA. Langley Research Center, High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 117-135 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

N92-33884*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PRELIMINARY RESULTS FROM THE WHITE SANDS MISSILE RANGE SONIC BOOM PROPAGATION EXPERIMENT
William L. Willshire, Jr. and David W. DeVilbiss (Lockheed Engineering and Sciences Co., Hampton, VA.) *In its* High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 137-149 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

N92-33885*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUBJECTIVE LOUDNESS RESPONSE TO SIMULATED SONIC BOOMS
Jack D. Leatherwood and Brenda M. Sullivan (Lockheed Engineering and Sciences Co., Hampton, VA.) *In its* High-Speed Research: Sonic Boom, Volume 1 Oct. 1992 p 151-170 (For primary document see N92-33874 24-05)
Avail: CASI HC A03/MF A03

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N92-33270# Argonne National Lab., IL.
FROM SUPERDEFORMATION TO CLUSTERS
R. R. Betts 1992 16 p Presented at the International Conference on Nuclear Structure at High Angular Momentum, Ottawa (Canada), 18-21 May 1992
(Contract W-31-109-eng-38)
(DE92-017067; ANL/CP-76545; CONF-9205108-6) Avail: CASI HC A03/MF A01

Much of the discussion at this conference has centered on the topic of superdeformed states in nuclei, and their study with the exquisitely precise tool of gamma ray spectroscopy, carried out with state-of-the-art detector arrays. In the usual way in which superdeformed states are populated, via compound nucleus formation and evaporation, gamma decay is the last process to occur in the decay chain. In some other sense, it is also the last to occur in the meaning of least likely. DOE

N92-33290# Northwestern Univ., Evanston, IL. Dept. of Materials Science and Engineering.
ATOMIC STRUCTURES AND COMPOSITIONS OF INTERNAL INTERFACES
D. N. Seidman and K. L. Merkle (Argonne National Lab., IL.) Mar. 1992 27 p
(Contract DE-FG02-89ER-45403)
(DE92-012136; DOE/ER-45403/3) Avail: CASI HC A03/MF A01

This research program addresses fundamental questions concerning the relationships between atomic structures and chemical compositions of metal/ceramic heterophase interfaces. The chemical composition profile across a Cu/MgO /111/-type heterophase interface, produced by the internal oxidation of a Cu(Mg) single phase alloy, is measured via atom-probe field-ion microscopy with a spatial resolution of 0.121 nm; this resolution is equal to the interplanar space of the /222/ MgO planes. In particular, we demonstrate for the first time that the bonding across a Cu/MgO /111/-type heterophase interface, along a group of zone axes (111) direction common to both the Cu matrix and an MgO precipitate, has the sequence Cu-O-Mg...and not Cu-Mg-O...; this result is achieved without any deconvolution of the experimental data. Before determining this chemical sequence it was established, via high resolution electron microscopy, that the morphology of an MgO precipitate in a Cu matrix is an octahedron faceted on /111/ planes with a cube-on-cube relationship between a precipitate and the matrix. First results are also presented for the Ni/Cr2O4 interface; for this system selected area atom probe microscopy was used to analyze this interface; Cr2O4 precipitates are located in a field-ion microscope tip and a precipitate is brought into the tip region via a highly controlled electropolishing technique. DOE

N92-33292# Minnesota Univ., Minneapolis. Dept. of Chemistry.
TEMPERATURE DEPENDENCE OF THE INVERTED REGIME ELECTRON TRANSFER KINETICS OF BETAINE-30 AND THE ROLE OF MOLECULAR MODES
Eva Akesson, Alan E. Johnson, Gilbert C. Walker, Nancy E. Levinger, and Thomas P. DuBruil 18 May 1992 15 p
(Contract N00014-89-J-1746)
(AD-A250729; TR-14) Avail: CASI HC A03/MF A01

The inverted regime photoinduced electron transfer kinetics of betaine-30 have been investigated over a broad temperature range, revealing very little temperature dependence. For example, for betaine-30 in a polystyrene film, the electron transfer rate constant, k(sub ET) changes by less than a factor of 3 from T = 293 K to T = 34 K. The results are in striking contrast to predictions of contemporary electron transfer theories which employ classical nuclear modes to accept some or all of the energy of the electron transfer event. The comparison of theory and experiment for the betaines demonstrates that a full quantum mechanical theory is necessary to accurately describe the electron transfer kinetics of the betaines in environments with slow dielectric relaxation. The conclusions drawn for the betaines may also apply to other molecular examples of inverted regime electron transfer in slowly relaxing environments. GRA

N92-33295# Argonne National Lab., IL.
SIX-DIMENSIONAL TRACKING RESULTS IN AN ULTRA-LOW EMITTANCE ELECTRON RING
L. Emery 1992 15 p Presented at the 4th Generation Light Sources Workshop, Stanford, CA, 24-27 Feb. 1992
(Contract W-31-109-eng-38)
(DE92-015189; ANL/CP-76124; CONF-9202111-3) Avail: CASI HC A03/MF A01

A dynamic aperture study with six-dimensional tracking on ultra-low emittance damping ring lattice is presented. A 1989 particle accelerator conference paper explained how the fast damping rate, the low emittance and the large dynamic aperture are achieved for this lattice using strong wigglers, a large circumference, many FODO cells, and non-interleaved sextupole pairs of vanishing second-order geometric aberration terms. In that report and another that followed, a dynamic aperture improvement with octupole correction to correct part of the third-order geometric aberrations was also reported. However, only the transverse phase space coordinates were used in particle tracking, which may be insufficient under some circumstances. Since this ring has a low momentum compaction factor (alpha)(sub c), the second-order effect of betatron oscillations on the path length becomes as significant as the effect of the momentum deviation. This coupling between transverse motion and longitudinal motion may reduce the calculated dynamic aperture for particles with no initial momentum deviation. For the damping ring presented here, the calculated dynamic aperture in six-dimensional phase space is reduced significantly from that calculated with transverse phase space coordinates only. Nevertheless, the dynamic aperture achieved with non-interleaved sextupole pairs remains much larger than of other possible sextupole configurations. DOE

N92-33425# Oak Ridge National Lab., TN.
ELECTRONIC POLARON EFFECTS IN MIXED VALENCE AND HEAVY FERMION MATERIALS
S. H. Liu May 1992 6 p Presented at the International Conference on the Physics of Transition Metals, Darmstadt (Germany), 20-24 Jul. 1992
(Contract DE-AC05-84OR-21400)
(DE92-015192; CONF-920762-1) Avail: CASI HC A02/MF A01

It is shown that the Coulomb interaction between (line integral) electrons and broad band electrons has a profound influence on the dynamical properties of a (line integral) hole in mixed valence and heavy fermion materials. At zero temperature, the dynamics of the screening process contains an infrared divergence. The broadening of this divergence by temperature causes the motion of the (line integral) electrons to crossover from wave propagation to diffusion. This mechanism explains the observed dual nature of the (line integral) electrons, namely that at low temperatures they behave like a Fermi liquid, while at high temperatures they evolve into localized magnetic moments. DOE

N92-33430# New Mexico Univ., Albuquerque.
SYNTHESIS AND CHARACTERIZATION OF SIMPLE SELF-ASSEMBLING, NANOPOROUS MONOLAYER ASSEMBLIES: A NEW STRATEGY FOR MOLECULAR RECOGNITION
Orawon Chailapakul and R. M. Crooks 6 Jul. 1992 24 p
(Contract N00014-91-J-1991)
(AD-A253035; TR-3) Avail: CASI HC A03/MF A01

Composite monolayer films spontaneously adsorb onto the surface of Au from an ethanolic mixture of two mercaptans to form a nanoporous surface. The monolayers consist of an electron transfer-retarding n-alkanethiol framework, which passivates the Au surface, and a much shorter aromatic mercaptan which induces molecule-sized defects within the passivating framework. Electrochemical experiments indicate that the chemical nature of the template and the template/framework ratio of the deposition solution control the size, number, and chemical characteristics of the defects. For example, 4-hydroxythiophenol/1-hexadecanethiol mixed monolayers yield assemblies that admit Ru(NH3)63(+) probe molecules but not Fe(CN)6(-3). GRA

N92-33450# Fermi National Accelerator Lab., Batavia, IL.
CONSTRUCTION OF THE CDF SILICON VERTEX DETECTOR
J. Skarha (Johns Hopkins Univ., Baltimore, MD.), B. Barnett (Johns Hopkins Univ., Baltimore, MD.), C. Boswell (Johns Hopkins Univ., Baltimore, MD.), F. Snider (Johns Hopkins Univ., Baltimore, MD.), A. Spies (Johns Hopkins Univ., Baltimore, MD.), J. Tseng (Johns Hopkins Univ., Baltimore, MD.), S. Vejcik (Johns Hopkins Univ., Baltimore, MD.), H. Carter, B. Flaugher, and B. Gonzales et al
Apr. 1992 7 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract DE-AC02-76CH-03000)
(DE92-014611; FNAL/C-92/111-E; CONF-911106-95) Avail: CASI HC A02/MF A01

Technical details and methods used in constructing the CDF silicon vertex detector are presented. This description includes a discussion of the foam-carbon fiber composite structure used in silicon microstrip detectors and the procedure for achievement of 5 micron detector alignment. The construction of the beryllium barrel structure, which houses the detector assemblies, is also described. In addition, the 10 micron placement accuracy of the detectors in the barrel structure is discussed and the detector cooling and mounting systems are described. DOE

N92-33521# Tennessee Univ., Knoxville. Dept. of Physics.
CHARGE EXCHANGE PHOTOPRODUCTION AND THE a1(1260)
G. T. Condo, T. Handler, and G. R. Blackett 1991 4 p Presented at the 4th International Conference on Hadron Spectroscopy, College Park, MD, 12-16 Aug. 1991
(Contract DE-FG05-91ER-40627)
(DE92-012267; CONF-910864-13) Avail: CASI HC A01/MF A01

Although recent analyses of tau-lepton decay and a reanalysis of hadron production data gave consistent results for the mass of the a(sub 1)(approximately 1250 MeV), other results, both experimental and theoretical, have suggested a significantly smaller value for this parameter. The purpose of this talk is to present our data on the charge-exchange photoproduction reaction, gamma(rho) (yields) (Delta)(++)(pi)(+) (pi)(-)(pi)(-). Our data derive from a hydrogen bubble chamber experiment, performed at SLAC, utilizing incident photons of average energy 19.3 GeV with a full width at half-maximum of 1.7 GeV. DOE

N92-33527# Washington Univ., Seattle. Dept. of Physics.
NUCLEON MODELS OF DEEP INELASTIC SCATTERING
G. A. Miller 1992 17 p Presented at the Riken Winter Seminar on Quarks and Gluons in Nucleons and Nuclei, Yuzawa (Japan), 8-12 Jan. 1992
(Contract DE-FG06-88ER-40427)
(DE92-014225; DOE/ER-40427/1-N92; CONF-9201106-1) Avail: CASI HC A03/MF A01

Nucleon models should describe both deep inelastic scattering and low energy phenomenology. We review some recent calculations of valence quark distributions. Models in which the valence quarks are the only dynamical variables fail to describe the data, since the valence quarks saturate the energy-momentum sum rule. This is in sharp disagreement with existing data which indicate that a substantial fraction of the nucleon's momentum is carried by glue and sea even for Q(sup 2) as low as 0.5 GeV(exp 2). DOE

N92-33661*# Eloret Corp., Palo Alto, CA.
ALL-ELECTRON MOLECULAR DIRAC-HARTREE-FOCK CALCULATIONS: PROPERTIES OF THE GROUP IV MONOXIDES GeO, SnO AND PbO
Kenneth G. Dyall (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.) 1991 22 p
(Contract NCC2-552)
(NASA-CR-190825; NAS 1.26:190825) Avail: CASI HC A03/MF A01

Dirac-Hartree-Fock calculations have been carried out on the ground states of the group IV monoxides GeO, SnO and PbO. Geometries, dipole moments and infrared data are presented. For comparison, nonrelativistic, first-order perturbation and relativistic effective core potential calculations have also been carried out. Where appropriate the results are compared with the experimental data and previous calculations. Spin-orbit effects are of great importance for PbO, where first-order perturbation theory including only the mass-velocity and Darwin terms is inadequate to predict the relativistic corrections to the properties. The relativistic effective

core potential results show a larger deviation from the all-electron values than for the hydrides, and confirm the conclusions drawn on the basis of the hydride calculations. Author

N92-33682# Oak Ridge National Lab., TN.
HIGHER SPIN STATES IN NEUTRON RICH NUCLEI
S. Zhu, X. Zhao, J. H. Hamilton, A. V. Ramayya, W. C. Ma, L. K. Peker, J. Kormicki, X. Hong, W. B. Gao, and J. K. Deng et al 1992 12 p Presented at the 15th Nuclear Physics Symposium, Oaxtepec (Mexico), 7-10 Jan. 1992
(Contracts DE-AC05-84OR-21400; DE-AC07-76ID-01570; DE-FG05-88ER-40407)
(DE92-015083; CONF-920117-1) Avail: CASI HC A03/MF A01

Nuclei on the neutron rich side of beta stability have long been of interest for nuclear structure studies because they probe different regions of the single particle spectrum and different shell gap combinations for both spherical and deformed shapes. However, such nuclei have been a difficult challenge experimentally. Much information has been gained about the properties of neutron rich nuclei at low spin from the study of radioactive isotopes produced in neutron induced, and more recently, proton induced fission of uranium. Such studies have been made possible by the use of isotope separators on line to reactors and more recently to low energy proton accelerators. However, to test many of the theoretical predictions of nuclear models one needs information about the higher spin states in nuclei in addition to their low spin states populated in radioactive decays. Higher spin states in neutron rich nuclei have been an even more difficult challenge than the lower spin states accessible through decay studies. One cannot reach the higher spin states in these nuclei by heavy ion fusion evaporation in reactions as carried out extensively for proton rich nuclei. Many years ago prompt spontaneous fission studies were used to suggest for the first time that Sr-98 and Zr-100 had unusually large ground state of deformations. The availability of higher efficiency multi-detector arrays of Compton suppressed Ge detectors has brought on a renewed interest in studies of the prompt gamma rays of the fragments from spontaneous and induced fission. Groups at Argonne, Daresbury, and a Vanderbilt-Oak Ridge-Idaho-Dubna collaboration have carried out several such studies from spontaneous and heavy-ion induced fission which have revealed new insights into our knowledge of neutron rich nuclei. This paper is primarily a review of these studies, including recent, unpublished results. DOE

N92-33714# Argonne National Lab., IL.
POSITION-SENSITIVE DETECTION OF SLOW NEUTRONS: SURVEY OF FUNDAMENTAL PRINCIPLES
R. K. Crawford 1992 14 p Presented at the SPIE International Symposium on Optical Applied Science and Engineering, San Diego, CA, 19-24 Jul. 1992
(Contract W-31-109-eng-38)
(DE92-016738; ANL/CP-75011; CONF-920792-5) Avail: CASI HC A03/MF A01

This paper sets forth the fundamental principles governing the development of position-sensitive detection systems for slow neutrons. Since neutrons are only weakly interacting with most materials, it is not generally practical to detect slow neutrons directly. Therefore all practical slow neutron detection mechanisms depend on the use of nuclear reactions to 'convert' the neutron to one or more charged particles, followed by the subsequent detection of the charged particles. The different conversion reactions which can be used are discussed, along with the relative merits of each. This is followed with a discussion of the various methods of charged particle detection, how these lend themselves to position-sensitive encoding, and the means of position encoding which can be applied to each case. Detector performance characteristics which may be of importance to the end user are discussed and related to these various detection and position-encoding mechanisms. DOE

N92-33812# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
INVESTIGATION OF FREE MOLECULES IN STATIC HOMOGENEOUS ELECTRICAL FIELDS, USING HIGH RESOLUTION LASER SPECTROSCOPY: SO2, NO2, NAPHTALENE, S-TETRAZINE Ph.D. Thesis [UNTERSUCHUNG FREIER MOLEKUELE IN STATISCHEN, HOMOGENEN ELEKTRISCHEN FELDERN MIT HILFE DER HOCHAUFLOESENDEN LASERSPEKTROSKOPIE: SO2, NO2, NAPHTHALIN, S-TETRAZIN]
Stefan Heitz 1991 146 p In GERMAN
(ETN-92-92141) Avail: CASI HC A07/MF A02

The behavior of some free molecules in static, homogeneous, electric fields was successfully examined. The molecules were prepared in a collimated supersonic jet with argon as a carrier gas, and examined using high resolution laser spectroscopy. Field strengths of 300 kV/cm could be produced in excitation volume. Dipole moments for SO2 and NO2, and polarizability for naphtalene and s-tetrazine could be determined in electronic ground state and in electronic excited condition. New field induced lines and crossings between single niveaus could be observed in the high energy spectra of the three atmomic molecules. The feasibility of polarizability measurements could be demonstrated for naphtalene and s-tetrazine. NO2 and SO2 measurements showed that the determination of dipole moments in strongly disturbed vibration conditions is problematic. ESA

N92-33888# Stanford Univ., CA. Linear Accelerator Center.
TWO GUAGE-BOSON PHYSICS AT VERY HIGH ENERGIES
J. D. Bjorken May 1992 5 p Presented at the 9th International Workshop on Photon-Photon Collisions, San Diego, CA, 22-26 Mar. 1992
(Contract DE-AC03-76SF-00515)
(DE92-017283; SU-SLAC-PUB-5823; CONF-9203159-5) Avail: CASI HC A01/MF A01

Use of the rapidity-gap signature can lead to observation of interesting processes involving collisions of gauge-bosons at the superconducting super collider. This includes production of the heavy Higgs boson (500 GeV-1 TeV), which appears straightforward. DOE

N92-33893# Stanford Univ., CA. Linear Accelerator Center.
AN OVERVIEW OF SPIN PHYSICS
C. Y. Prescott Jul. 1991 7 p Presented at the 4th Conference on the Intersections between Particle and Nuclear Physics, Tucson, AZ, 23-29 May 1991
(Contract DE-AC03-76SF-00515)
(DE92-018152; SU-SLAC-PUB-5604; CONF-9105106-38) Avail: CASI HC A02/MF A01

Spin physics is playing an increasingly important role in high energy experiments and theory. This review looks at selected topics in high energy spin physics that were discussed at the 9th International Symposium on High Energy Spin Physics at Bonn in September 1990. DOE

N92-33946# Kansas Univ., Lawrence. Dept. of Chemistry.
ATOMIC PHYSICS IN STRONG FIELDS
Shih-I. Chu Apr. 1992 20 p
(Contract DE-FG02-90ER-14159)
(DE92-015356; DOE/ER-14159/2) Avail: CASI HC A03/MF A01

A summary of the major accomplishments and progress made in this period is presented. The following topics are discussed: microwave driven multiphoton excitation dynamics in rydberg atoms; nonadiabatic geometric phases of multiphoton transitions in dissipative systems and spin-j systems; and nonperturbative treatments of atomic and molecular processes in intense laser fields. DOE

N92-33973# Oak Ridge National Lab., TN.
MEASUREMENT OF ATOMIC MEAN VIBRATION AMPLITUDE BY EELS OF HIGH-ANGLE PHONON SCATTERED ELECTRONS: A NOVEL TECHNIQUE

Z. L. Wang 1992 3 p Presented at the Annual Meeting of the Electron Microscopy Society (EMS) of America, Boston, MA, 16-21 Aug. 1992 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE92-009004; CONF-920819-1) Avail: CASI HC A01/MF A01

A new technique, thermal-diffuse-scattered electron energy-loss spectroscopy (TDS-EELS), was developed for measurement of atomic mean vibration amplitudes in small crystals. This technique is performed in the dark-field image mode with a large-angle, ring-shaped annular objective aperture in a conventional transmission electron microscopy. TDS-EELS is based on high-angle phonon-atomic inner-shell, simultaneous inelastic scattering processes, and could be adequately applied to measure the atomic vibration amplitudes in crystalline, disordered, or amorphous materials of small sizes if the different ionization cross-section data are available. DOE

N92-33977# Columbia Univ., New York, NY. Dept. of Physics.
RELATIVISTIC HEAVY ION RESEARCH
Shoji Nagamiya 1992 14 p
(Contract DE-FG02-86ER-40281)
(DE92-016285; DOE/ER-40281/T2) Avail: CASI HC A03/MF A01

This report discusses the following topics: antiproton production; Bose-Einstein correlations; high-transverse momentum spectra; strangeness enhancement in heavy ion collisions; search for rare negative secondaries of antiprotons and antinuclei produced in heavy ion collisions; quark matter; and time-of-flight systems test at Brookhaven AGS. DOE

N92-34021# International Business Machines Corp., San Jose, CA.
PHOTON ANTIBUNCHING IN THE FLUORESCENCE OF A SINGLE DYE MOLECULE TRAPPED IN A SOLID Interim Report
Th. Basche and W. E. Moerner 8 Jun. 1992 16 p
(Contract N00014-91-C-0166)
(AD-A252261; IBM-RJ8793; TR-37) Avail: CASI HC A02/MF A01

The correlation between fluorescence photons emitted by an optically pumped single molecule of pentacene in a p-terphenyl host has been investigated at short times. The correlation function shows photon antibunching, a unique feature of nonclassical radiation field, which decreases if two molecules rather than one are pumped at the same time. The peculiarities of the correlation function for a three-level molecule are discussed and the theoretical description outlined. GRA

N92-34034# Rochester Univ., NY. Dept. of Physics and Astronomy.
THEORETICAL AND EXPERIMENTAL STUDIES OF ELEMENTARY PHYSICS
A. Bodek, T. Ferbel, A. C. Melissinos, S. Olsen, P. Slattery, P. Tipton, A. Das, C. R. Hagen, S. G. Rajeev, and S. Okubo May 1992 158 p
(Contract DE-AC02-76ER-13065)
(DE92-015972; DOE/ER-13065/716) Avail: CASI HC A08/MF A02

The experimental high energy physics program is directed toward the execution of experiments that probe the basic constituents of matter and the forces between them. These experiments are carried out at national and international accelerator facilities. At the current time, we are primarily concentrating on the following projects: direct photon production in hadronic reactions; production of hybrid mesons in the nuclear coulomb field; the D-Zero experiment at the Tevatron collider; deep inelastic neutrino- and electron-nucleon scattering at FNAL and SLAC; nonlinear QED at critical field strengths at SLAC; the experiments at KEK (AMY, 17keV neutrino); the CDF experiment at the Tevatron collider; and SSC-related detector R&D on scintillating tile- and diamond-based calorimetry and microstrip tracking detectors. DOE

N92-34077# California Univ., Berkeley. Lawrence Berkeley Lab.
THE DYNAMICS OF AZULENE IN LIQUIDS AND COMPRESSED GASES ON ULTRAFAST TIMESCALES Ph.D. Thesis
K. E. Schultz Feb. 1992 126 p
(Contract DE-AC03-76SF-00098)
(DE92-017122; LBL-31926) Avail: CASI HC A07/MF A02

The ultrafast dynamics of vibrationally hot ground state azulene molecules have been time resolved by picosecond transient absorption spectroscopy in a variety of solvents including hexane, chloromethanes, methanol, CCIF3, Xe and Kr. A high pressure optical cell was used to liquify gases for use as solvents and change their density and temperature, independently, over the entire liquid density range. Experimental results indicate the vibrational cooling rate is strongly solvent dependent, with cooling rates of approximately 20 psec in molecular solvents and approximately 150 psec in atomic solvents. Comparison of the rates in Xe and Kr at constant density demonstrates the strong effect of solvent mass on energy transfer. The effect of solvent temperature on vibrational cooling is minimal, as is the effect of solvent density. This latter result is quite surprising in light of earlier experiments on simpler molecular systems, such as I2 in Xe. This anomalous density effect is examined in light of Isolated Binary Collision (IBC) theory and bulk thermal transport models. Both theories accurately model all experimental results obtained with the exception of the density effort. Possible explanations for the breakdown of the IBC theory in this case are offered along with methods to improve IBC theory for application to complex three dimensional molecular systems. DOE

N92-34116# Oak Ridge National Lab., TN.
CAN MOLECULES BE SEEN BY TWO PHOTONS?
T. Barnes 1992 9 p Presented at the 9th International Workshop on Photon-Photon Collisions, San Diego, CA, 22-26 Mar. 1992 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE92-016524; CONF-9203159-4) Avail: CASI HC A02/MF A01

We discuss theoretical expectations for the (gamma)(gamma) partial widths of weakly-bound meson-meson 'molecule' states such as the K(bar-K) molecule candidates f(sub 0)(75) and a(sub 0)(980). The theoretical consensus is that such states should have (gamma)(gamma) partial widths about an order of magnitude smaller than expectations for q(bar-q) states with similar masses. This discriminating power implies that resonance production in (gamma)(gamma) collisions will be a useful experimental technique for identifying molecules. Experimental results for the (gamma)(gamma) partial widths of the f(sub 0)(975) and a(sub 0)(980) support their identifications as molecules. Other possibilities for molecules, including the f(sub 0)(1720), are discussed. DOE

N92-34126# Stevens Inst. of Tech., Hoboken, NJ. Dept. of Physics and Engineering Physics.
SURFACE PRODUCTION OF IONS Final Report, 1 Oct. 1989 - 30 Apr. 1992
Milos Seidl 26 May 1992 102 p
(Grant AF-AFOSR-0019-90)
(AD-A253434; AFOSR-92-0683TR) Avail: CASI HC A06/MF A01

Surface production of negative hydrogen ions by electron transfer from solid surfaces to backscattered hydrogen atoms was investigated. The low-energy hydrogen atoms were produced by thermal dissociation or electron impact dissociation of hydrogen gas and by deceleration of a proton beam. A highly stable cesium oxide converter surface, giving the highest observed yield for surface production of H(-) ions, was developed. A microwave discharge producing an intense flux of superthermal hydrogen atoms was built and tested. This opens up new approaches to the design of H(-) ion sources. Resonant charge transfer in hydrogen atom scattering from surfaces was theoretically studied. Several models of solid state cesium ion guns were developed and used for surface studies. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N92-33260# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
ADIABATIC DISRUPTION OF ASYMMETRIC COLLIDING BEAMS
T. Katsouleas (University of Southern California, Los Angeles.) and J. S. Wurtele 1991 6 p Presented at the 5th International Committee for Future Accelerators (ICFA) Beam Dynamics Workshop, Corpus Christi, TX, 3-8 Oct. 1991
(Contract DE-FG02-91ER-40648)
(DE92-015604; CONF-9110243-18) Avail: CASI HC A02/MF A01

A scheme is considered for enhancing the luminosity of electron-positron colliders. One of the beams is taken to be much denser than the other and effectively becomes a lens for the second beam. The luminosity enhancement afforded by this asymmetric disruption process is estimated analytically. The scheme is severely limited by the kink instability which is characterized by a two-stream dispersion relation, and a constraint on the density of the less dense beam is found for which the instability is gradient stabilized. DOE

N92-33403# Yale Univ., New Haven, CT. Dept. of Physics.
SEARCH FOR STRANGE QUARK MATTER AND ANTIMATTER PRODUCED IN HIGH ENERGY HEAVY ION COLLISIONS
1992 18 p
(Contract DE-FG02-90ER-40562)
(DE92-015678; DOE/ER-40562/2) Avail: CASI HC A03/MF A01

This document describes the development and progress of our group's research program in high energy heavy ion physics. We are a subset of the Yale experimental high energy physics effort (YAUG group) who became interested in the physics of high energy heavy ions in 1988. Our interest began with the possibility of performing significant searches for strange quark matter. As we learned more about the subject and as we gained experimental experience through our participation in AGS experiment 814, our interests have broadened. Our program has focused on the study of new particles, including (but not exclusively) strange quark matter, and the high sensitivity measurement of other composite nuclear systems such as antinuclei and various light nuclei. The importance of measurements of the known, but rare, nuclear systems lies in the study of production mechanisms. A good understanding of the physics and phenomenology of rare composite particle production is essential for the interpretation of limits to strange quark matter searches. We believe that such studies will also be useful in probing the mechanisms involved in the collision process itself. We have been involved in the running and data analysis for AGS E814. We have also worked on the R&D for AGS E864, which is an approved experiment designed to reach sensitivities where there will be a good chance of discovering strangelets or of setting significant limits on the parameters of strange quark matter. DOE

N92-33445# Fermi National Accelerator Lab., Batavia, IL.
P-BAR P COLLIDER PHYSICS
M. Demarteau (State Univ. of New York, Stony Brook.) Apr. 1992 80 p Presented at the 1991 Joint Belgian-Dutch-German School of Particle Physics, Aachen, Fed. Republic of Germany, 9-20 Sep. 1991
(Contract DE-AC02-76CH-03000)
(DE92-014164; FNAL/C-92/103; CONF-9109381-1) Avail: CASI HC A05/MF A01

A brief introduction to (bar-p)p collider physics is given. Selected results from the collider experiments at the CERN S(bar-p)pS and the Tevatron collider are described. The emphasis is on experimental aspects of (bar-p)p collisions. Minimum bias physics and the production of jets, Intermediate Vector Bosons, and heavy flavors are reviewed. The outlook for physics at hadron colliders for the near future is briefly discussed. DOE

N92-33453# Sandia National Labs., Albuquerque, NM.
APPLICATION OF MAGNETICALLY INSULATED TRANSMISSION LINES FOR HIGH CURRENT, HIGH VOLTAGE ELECTRON BEAM ACCELERATORS
S. L. Shope, M. G. Mazarakis, C. A. Frost, J. W. Poukey, and B. N. Turman 1991 7 p Presented at the 9th International Conference on High Power Particle Beams, Washington, DC, 25-29 May 1992
(Contract DE-AC04-76DP-00789)
(DE92-015045; SAND-91-2475C; CONF-920515-8) Avail: CASI HC A02/MF A01

Self Magnetically Insulated Transmission Lines (MITL) adders were used successfully in a number of Sandia accelerators such as HELIA, HERMES III, and SABRE. Most recently we used at MITL adder in the RADLAC/SMILE electron beam accelerator to produce high quality, small radius (r(sub rho) less than 2 cm), 11 - 15 MeV, 50 - 100-kA beams with a small transverse velocity v(perpendicular)/c = beta(perpendicular) less than or equal to 0.1. In RADLAC/SMILE, a coaxial MITL passed through the eight, 2 MV vacuum envelopes. The MITL summed the voltages of all eight feeds to a single foilless diode. The experimental results are in good agreement with code simulations. Our success with the MITL technology led us to investigate the application to higher energy accelerator designs. We have a conceptual design for a cavity-fed MITL that sums the voltages from 100 identical, inductively-isolated cavities. Each cavity is a toroidal structure that is driven simultaneously by four 8-ohm pulse-forming lines, providing a 1-MV voltage pulse to each of the 100 cavities. The point design accelerator is 100 MV, 500 kA, with a 30 - 50 ns FWHM output pulse. DOE

N92-33632# California Univ., Berkeley. Lawrence Berkeley Lab.
IDEAS FOR FUTURE SYNCHROTRON LIGHT SOURCES
A. Jackson, W. Hassenzahl, and M. Meddahi Mar. 1992 5 p Presented at the 3rd European Particle Accelerator Conference, Berlin (Germany), 24-28 Mar. 1992
(Contract DE-AC03-76SF-00098)
(DE92-017108; LBL-31172; CONF-920315-42) Avail: CASI HC A01/MF A01

Synchrotron light sources have advanced in the past two-to-three decades through three 'generations', from irritating parasitic sources on high-energy physics accelerators to dedicated electron and positron storage rings of unprecedented low emittance, utilizing undulator and wiggler magnets. The evolution through these three generations followed a predictable, science-driven course towards brighter beams of VUV- and x-radiation. The requirements of future light sources is not so clear. The limit on low emittance has certainly not been reached, and diffraction-limited sources at shorter wavelengths would be the natural progression from previous generations. However, scientists are now looking at other radiation characteristics that might better serve their needs, for example, more coherent power, fast switching polarization, ultra-short (sub-picosecond) time structure, and synchronized beams for pump-probe experiments. This paper discusses some current ideas that might drive the fourth-generation synchrotron light source. DOE

N92-33680# Argonne National Lab., IL.
OUTLINE OF A PROPOSAL FOR A NEW NEUTRON SOURCE: THE PULSED NEUTRON RESEARCH FACILITY
B. S. Brown, J. M. Carpenter, and R. L. Kustom Apr. 1992 13 p Presented at the 114th Enrico Fermi School of Physics, La Specia, Italy, 19-29 Jun. 1990
(Contract W-31-109-eng-38)
(DE92-014850; ANL/CP-75946; CONF-9006235-4) Avail: CASI HC A03/MF A01

Accelerator-based, pulsed spallation neutron sources have been performing neutron scattering research for about fifteen years.

During this time beam intensities have increased by a factor of 100 and more than 50 spectrometers are now operating on four major sources worldwide. The pulsed sources have proven to be highly effective and complementary to reactor-based sources in that there are important scientific areas for which each type of source has unique capabilities. We describe a proposal for a new pulsed neutron facility based on a Fixed Field Alternating Gradient synchrotron. The specifications for this new machine, which are now only being formulated, are for an accelerator that will produce (100 divided by 200) mu-A of time-averaged proton current at (500 divided by 1000) MeV, in short pulses at 30 Hz. Appropriate target and moderator systems and an array of scattering instruments will be provided to make the facility a full-blown research installation. The neutron source, named the Pulsed Neutron Research Facility (PNRF), will be as powerful as any pulsed source now operating in the world and will also act as a test bed for the Fixed Field Alternating Gradient Synchrotron concept as a basis for more powerful sources in the future. The peak thermal neutron flux in PNRF will be about 5 x 10(sup 15)n/cm(sup 2) x s. DOE

N92-33982# Argonne National Lab., IL.
THE IFR ROUTE TO SAFE, RELIABLE AND INEXHAUSTIBLE POWER
W. H. Hannum 1992 6 p Presented at the Bi-Annual Nuclear Energy Meeting of the ANS and the ASME, San Diego, CA, 23-26 Aug. 1992
(Contract W-31-109-eng-38)
(DE92-017070; ANL/CP-76210; CONF-920818-4) Avail: CASI HC A02/MF A01

The Integral Fast Reactor is a closed reactor fuel cycle composed of a metal fuelled, tank type, sodium cooled fast reactor; an electrochemical process for recovery of actinides from spent fuel; a simplified refabrication technology; and the associated waste processing technology. Feasibility of the reactor concept is established. Favorable safety attributes are recognized. The integral fuel cycle demonstration is being assembled. Good progress is being made in developing the associated waste processing technology. DOE

N92-34015# Duke Univ., Durham, NC. Dept. of Physics.
NUCLEAR PHYSICS AT EXTREME ENERGY DENSITY
B. Mueller 15 May 1992 57 p
(Contract DE-FG05-90ER-40592)
(DE92-014338; DOE/ER-40592/2) Avail: CASI HC A04/MF A01

This report discusses topics in the following areas: QCD transport theory; minijets in hadronic and nuclear collisions; lattice gauge theory; hadronic matter and other studies; and strong electromagnetic fields. DOE

N92-34040# Sandia National Labs., Albuquerque, NM.
INITIAL RESULTS FROM THE RHEPP MODULE
H. C. Harjes, K. J. Penn, K. W. Reed, C. R. McClenahan, G. E. Laderach, R. W. Wavrik, J. L. Adcock, M. E. Butler, G. A. Mann, and G. E. Pena et al 1992 9 p Presented at the 9th International Conference on High Power Particle Beams, Washington, DC, 25-29 May 1992
(Contract DE-AC04-76DP-00789)
(DE92-016792; SAND-91-2569C; CONF-920515-28) Avail: CASI HC A02/MF A01

Several potential applications such as medical waste treatment, chemical waste treatment, food treatment, and flue gas cleanup have been identified for high average power electron beam systems. In the RHEPP (Repetitive High Energy Pulsed Power) project, the technology for such a system is being developed. The RHEPP module consists of a magnetic pulse compressor driving a linear induction voltage adder with an e-beam diode load. It has been designed to operate continuously, delivering 350 kW of average power to the diode in 60-ns FWHM, 2.5 MV, 2.9 kJ pulses. The module is presently under construction with the first phase scheduled for completion in the summer of 1992. In the first phase, four of ten adder stages are being built so that testing can begin with a 1 MV, 160 kW diode with the balance of the power from the compressor diverted to a resistive load. A description of the system and test results from the initial stages of the compressor will be presented. DOE

N92-34065# Superconducting Super Collider Lab., Dallas, TX.
CONCEPT DESIGN OF THE HIGH VOLTAGE TRANSMISSION SYSTEM FOR THE COLLIDER TUNNEL
L. S. Norman Mar. 1992 7 p Presented at the International Industrial Symposium on the Super Collider, New Orleans, LA, 4-6 Mar. 1992
(Contract DE-AC35-89ER-40486)
(DE92-013956; SSCL-Preprint-98; CONF-920331-8) Avail: CASI HC A02/MF A01

In order to provide electrical service to the Superconducting Super Collider Laboratory (SSCL) 54-mile-circumference collider of 125 MVA at 69 kV or 155 MVA at 138 kV of distributed power, it must be demonstrated that the concept design for a high-voltage transmission system can meet the distribution requirements of the collider electrical system with its cryogenic system's large motor loads and its pulsed power technical systems. It is a practical design, safe for operating personnel and cost-effective. The normal high-voltage transmission techniques of overhead and underground around the 54-mile collider tunnel could not be applied because of technical and physical constraints, or was environmentally unacceptable. The approach taken to solve these problems is the installation of 69-kV or 138-kV exposed solid dielectric transmission cable inside the collider tunnel with the superconducting magnets, cryogenic piping, electrical medium, and low-voltage distribution systems, and electronic/instrumentation wiring systems. This mixed-use approach has never been attempted in a collider tunnel. Research into all aspects of the engineering and installation problems and consultation with transmission cable manufacturers, electrical utilities, and European entities with similar installations--such as the Channel Tunnel--demonstrate that the concept design is feasible and practical. This paper presents a history of the evolution of the concept design. Design studies are underway to determine the system configuration and voltages. Included in this report are tunnel transmission cable system considerations and evaluation of solid dielectric high-voltage cable design. DOE

N92-34066# Oak Ridge National Lab., TN.
FUSION REACTOR MATERIALS Semiannual Progress Report, period ending 30 Sep. 1991
Apr. 1992 330 p
(Contract DE-AC05-84OR-21400)
(DE92-014912; DOE/ER-0313-11; ORNL/M-1945) Avail: CASI HC A15/MF A03

The following areas of thermonuclear reactor materials are discussed: irradiation facilities, test matrices, and experimental methods; dosimetry, damage parameters, and activation calculations; materials engineering and design requirements; fundamental mechanical behavior; radiation effects; development of structural alloys; solid breeding materials and beryllium; and ceramics. These papers have been indexed separately elsewhere. DOE

N92-34070# Sandia National Labs., Albuquerque, NM.
SIMULATIONS OF MULTISTAGE INTENSE ION BEAM ACCELERATION
S. A. Slutz and J. W. Poukey 1991 6 p Presented at the 9th International Conference on High Power Particle Beams, Washington, DC, 25-29 May 1992
(Contract DE-AC04-76DP-00789)
(DE92-015002; SAND-91-2501C; CONF-920515-5) Avail: CASI HC A02/MF A01

An analytic theory for magnetically insulated, multistage acceleration of high intensity ion beams, where the diamagnetic effect due to electron flow is important, has been presented by Slutz and Desjarlais. The theory predicts the existence of two limiting voltages called V(sub 1)(W) and V(sub 2)(W), which are both functions of the injection energy qW of ions entering the

accelerating gap. As the voltage approaches V(sub 1)(W), unlimited beam-current density can penetrate the gap without the formation of a virtual anode because the dynamic gap goes to zero. Similarly, unlimited beam current can penetrate an accelerating gap above V(sub 2)(W). It was found that the behavior of these limiting voltages is strongly dependent on the electron density profile. We have investigated the behavior of these limiting voltages numerically using the 2-D particle-in-cell (PIC) code MAGIC. Results of these simulations are consistent with the superinsulated analytic results. This is not surprising, since the ignored coordinate eliminates instabilities known to be important from studies of single stage magnetically insulated ion diodes. To investigate the effect of these instabilities we have simulated the problem with the 3-D PIC code QUICKSILVER, which indicates behavior that is consistent with the saturated model. DOE

N92-34083# California Inst. of Tech., Pasadena.
RESEARCH IN HIGH ENERGY PHYSICS
1991 290 p
(Contract DE-AC03-81ER-40050)
(DE92-016008; DOE/ER-40050/T8) Avail: CASI HC A13/MF A03

This report discusses progress in the following research in high energy physics: The crystal ball experiment; delco at PEP; proton decay experiment; MACRO detector; Mark III detector; SLD detector; CLEO II detector; and the Caltech L3 group. DOE

N92-34087# Lawrence Livermore National Lab., CA.
TECHNICAL PROBLEMS AND SOLUTIONS OF INTENSE, FAST NEUTRON GENERATORS
D. W. Heikkinen 26 May 1992 11 p Presented at the Meeting on Low-Energy Accelerators, Debrecen, Hungary, 1-5 Jun. 1992
(Contract W-7405-eng-48)
(DE92-017255; UCRL-JC-110752; CONF-9206209-1) Avail: CASI HC A03/MF A01

The primary source of intense neutrons using low energy accelerators has been the T(d,n)(sup 4)He reaction. This reaction produces nominal 14-MeV neutrons which have been used for cross section and nuclear structure measurements for a great many years. As the years progressed, higher intensities were obtained and as higher intensities were obtained new uses for 14-MeV neutrons became feasible. In fact, the most intense 14-MeV neutron sources in use at the present time are devoted to the fusion program. Among these are Oktavian located at Osaka University, Japan and the Fusion Neutronics Source at the Japan Atomic Energy Research Institute. These facilities both have neutronics programs for fusion energy. Lawrence Livermore National Laboratory (LLNL) had two facilities which were used in the past decade for fusion materials studies. These were the RTNS-II and RTNS-I facilities. Both of these facilities ceased operation at least five years ago. The need for intense fast neutron sources in the fusion program still exists. In this paper we will describe the generic rotating target neutron source but paying particular attention to the RTNS-II facility. This facility provided the most intense source of 14-MeV neutrons while operational with a source strength approaching 4 x 10(exp 13) n/s. Higher intensity neutron sources with median energies around approx. 15 MeV have been proposed. These are based on the d + Li reaction using approx. 35 MeV deuterons. However, none of these have been built to my knowledge. DOE

N92-33331*# General Electric Co., Philadelphia, PA.
NEAR-TERM THERMOELECTRIC NUCLEAR POWER OPTIONS FOR SEI MISSIONS
Jerry R. Peterson *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 373-385
(For primary document see N92-33309 24-12)
Avail: CASI HC A03/MF A05

N92-33335*# Los Alamos National Lab., NM.
NUCLEAR THERMAL ROCKET BY 2000: A DOE PERSPECTIVE
Steven D. Howe and Marland Stanley (Idaho National Engineering Lab., Idaho Falls.) *In* NASA. Lyndon B. Johnson Space Center, Third SEI Technical Interchange: Proceedings 1992 p 437-444
(For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N92-33455# Sandia National Labs., Albuquerque, NM.
TOWARD RED-EMITTING, RADIATION TOLERANT CHROMOPHORES
P. A. Cahill 1992 17 p Presented at the International Conference of Radiation-Tolerant Scintillators and Detectors, Tallahassee, FL, 28 Apr. - 2 May 1992
(Contract DE-AC04-76DP-00789)
(DE92-016498; SAND-92-0975C; CONF-9204138-4) Avail: CASI HC A03/MF A01

The current state of red-shifted fluorescent dyes is reviewed from the viewpoint of Superconductor Super Collider (SSC) design constraints (emission wavelength, lifetime, radiation-tolerance, quantum yield, etc.) and theoretical limitations (Einstein coefficients, natural lifetimes, oscillator strengths). Improvements to the performance of current red-emitting fluors which are simultaneously optimized to meet these constraints are needed, and the suggestion of applying computational methods to molecular design of fluorescent chromophores is presented by example. Emphasis is placed on dyes which emit at wavelengths longer than 500 nm, and in particular near 630 nm, the window of maximum transmittance of polystyrene plastic optical fiber. DOE

N92-33529# ERG Systems, Inc., Saint James, NY.
FULL SURFACE TESTING OF GRAZING INCIDENCE MIRRORS Quarterly Report No. 7, 12 Mar. - 11 Jun. 1992
John L. Remo 12 Jun. 1992 20 p
(Contract N00014-90-C-0246)
(AD-A252253) Avail: CASI HC A02/MF A01

In the present report, we present the work done during the period of 12 Mar. to 11 Jun. 1992. The tasks include work on the preparation of the user manual and software documentation, as well as additional testing and modifications. This report includes a detailed presentation of several topics: (1) the user manual describing the operation of the interferometer system; (2) the system operation is menu driven using the function keys for the various steps; (3) a software package overview describing the various subprograms included in the package; (4) the program source code, including the main menu program, the motion control programs, and the data processing programs; and (5) the specification sheets of the motion control hardware, including micro-stepper and linear scanning stage. During the next period we will work on the following tasks: (1) complete the user manual and documentation; (2) complete the testing program and implement the final modifications; and (3) prepare the final report. GRA

N92-33546# Department of the Navy, Washington, DC.
FIBER-OPTIC TESTING SYSTEM HAVING A DETECTION CIRCUIT Patent Application
Francis L. Needham, inventor (to Navy) 26 May 1992 18 p
(AD-D015331; US-Patent-Appl-SN-888074; Navy-Case-74156)
Avail: CASI HC A03/MF A01

A system for testing a fiber-optic component with infrared radiation is provided. The testing system has a source of infrared radiation, an optic coupler, a detecting circuit, and an analog tape recorder. The optic coupler directs the infrared radiation onto the fiber-optic component. The detection circuit is electrically connected to the tape recorder. The detection circuit has an amplifier, a potentiometer connected in parallel to the amplifier, and a photoelectric transducer connected in series to the amplifier. These components are mounted on a non-conductive board. A power

source supplies voltage and is connected to the amplifier. The circuit operates by having the photoelectric transducer sense the infrared radiation emitted from the tested fiber-optic component and convert the radiation into an electrical signal. The amplifier then amplifies the electrical signal to the voltage necessary for driving the tape recorder. GRA

N92-33554# Argonne National Lab., IL.
X RAY INTENSITY INTERFEROMETER FOR UNDULATOR RADIATION
E. Gluskin, I. McNulty, P. J. Viccaro, and M. R. Howells (California Univ., Berkeley. Lawrence Berkeley Lab.) 1991 14 p Presented at the 7th National Conference and Exhibition on Synchrotron Radiation Instrumentation, Baton Rouge, LA, 28-31 Oct. 1991
(Contracts W-31-109-eng-38; DE-AC03-76SF-00098)
(DE92-015184; ANL/CP-76025; CONF-9110146-19) Avail: CASI HC A03/MF A01

Intensity interferometry is well established with visible light but has never been demonstrated with x-radiation. We propose to measure the transverse coherence of an x-ray beam, for the first time, using the method of Hanbury Brown and Twiss. The x-ray interferometer consists of an array of slits, a grazing incidence reflective beamsplitter, a pair of fast multichannel plate detectors and a broadband, low-noise correlator circuit. The NSLS X1 or X13 soft x-ray undulator will supply the partially coherent x-rays. We are developing this technique to characterize the coherence properties of x-ray beams from high brilliance insertion devices at third-generation synchrotron light facilities such as the Advanced Photon Source and the Advanced Light Source. DOE

N92-33598# York Univ., Toronto (Ontario). Human Performance in Space Lab.
VECTION AND INDUCED VISUAL MOTION Final Report
Ian P. Howard 15 Dec. 1991 109 p
(Contract DCIEM-W7711-9-7071/01-XSE)
(CTN-92-60592) Avail: CASI HC A06/MF A02

When exposed to a large moving visual display, a person experiences illusory self motion (vection). Specialized devices were used to investigate the relation between illusory visual motion of stationary objects and illusory self motion induced by motion of a visual scene. In a first set of experiments, two distinct components of induced visual motion were measured: exocentric induced motion which causes a stationary object to appear to move with the self, and egocentric induced motion which causes an object to seem to move relative to the self. Another set of experiments was designed to reveal the extent to which vection depends on the presence of stationary objects in the field of view and to explore what types of relative motion between the moving display and the stationary objects most strongly induce vection. It was observed that when all stationary objects were removed, vection had a long latency and was very weak when it occurred. A third set of experiments was designed to reveal the extent to which illusory body tilt induced by viewing a tilted or rotating scene depends on the motion of a visual stimulus and on the geometrical features of the stimulus. The results reveal the relative contributions of visual polarity and visual motion to illusory body tilt and the extent to which visual stimuli can override conflicting stimuli arising from the otolith organs. Author (CISTI)

N92-33602*# Alabama Univ., Birmingham. Dept. of Physics.
ADVANCED WATER WINDOW X-RAY MICROSCOPE DESIGN AND ANALYSIS Final Report, 1992
D. L. Shealy, C. Wang, W. Jiang, and J. Lin 11 Sep. 1992 36 p
(NASA Order H-08073-D)
(NASA-CR-190738; NAS 1.26:190738) Avail: CASI HC A03/MF A01

The project was focused on the design and analysis of an advanced water window soft-x-ray microscope. The activities were accomplished by completing three tasks contained in the statement of work of this contract. The new results confirm that in order to achieve resolutions greater than three times the wavelength of the incident radiation, it will be necessary to use aspherical mirror surfaces and to use graded multilayer coatings on the secondary (to accommodate the large variations of the angle of incidence over the secondary when operating the microscope at numerical apertures of 0.35 or greater). The results are included in a manuscript which is enclosed in the Appendix. Author

N92-33623# Optical Society of America, Washington, DC.
OSA PROCEEDINGS OF THE INTERNATIONAL TOPICAL MEETING ON PHOTONIC SWITCHING, VOLUME 8 Final Report
H. S. Hinton and Joseph W. Goodman 22 May 1992 292 p Meeting held in Salt Lake City, UT, 6-8 Mar. 1992
(Grant AF-AFOSR-0176-91)
(AD-A253026; AFOSR-92-0518TR-Vol-8) Avail: CASI HC A13/MF A03

The papers in this book stem from the Third Topical Meeting on Photonic Switching organized by the Optical Society of America and held in Salt Lake City in March of 1991. The papers in this book consist of extended and enhanced submissions from authors who participated in the meeting. The papers have been grouped into eight sections: Space-Division Switching (guided-wave), Space-Division Switching (freespace), Time-Division Switching, Wavelength-Division Switching, Multi-Divisional Switching, Logic and Control, Optical Interconnection, and Novel Devices. Finally, the papers contained within this volume represent the leading edge of research in photonic switching, therefore, the reader should gain a reasonably balanced overview of the current state of photonic switching. GRA

N92-33659*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Physics.
SPATIOTEMPORAL DYNAMICS AND OPTICAL VORTICES IN A PHOTOREFRACTIVE PHASE-CONJUGATE RESONATOR
Siuying Raymond Liu and Guy Indebetouw 1992 58 p
(Grant NAG1-1363)
(NASA-CR-190823; NAS 1.26:190823) Avail: CASI HC A04/MF A01

A truncated modal expansion approach is used to study the spatiotemporal dynamics of a phase-conjugate resonator as a function of Bragg detuning. The numerical results reveal a rich variety of behaviors. Emphasis is given to the spatial distribution of optical vortices, their trajectories and their relationship to the beam's spatial coherence. The limitations of the model are discussed and experimental results are presented for comparison with the model's predictions and assessment of its soundness. Author

N92-33744# Bertin et Cie., Aix-les-Milles (France).
SILEX BEACON EQUIPMENT
P. J. Crepin, P. Leblay, and D. Malaise (Spacebel Instrumentation, Angleur, Belgium) 1991 18 p
(ETN-92-91715) Avail: CASI HC A03/MF A01

The design and breadboarding of the beacon of the SILEX experimental optical link between geosynchronous Earth orbit and low Earth orbit terminals are considered. The aim of the SILEX experiment is to establish an intersatellite optical telecommunication link. The beacon will provide a powerful continuous wave light beam to allow terminal telescope alignment during acquisition phase. The beacon consists of four parts: the beacon electronics, the beacon emission unit, the optical fiber harness, and the beacon head. The system is described, special attention being given to the optical features. ESA

N92-33802# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.
EXACT ANALYSIS OF AN INTEGRATED-OPTICAL POLARISATOR ON THE BASIS OF LINbO3 Ph.D. Thesis [EXAKTE ANALYSE EINES INTEGRIERT-OPTISCHEN POLARISATORS AUF DER BASIS VON LINBO3]
Torsten Soetbeer 1991 165 p In GERMAN
(ETN-92-92133) Avail: CASI HC A08/MF A02

The exact calculation of wave propagation in a tape waveguide is reported, with regard to the two dimensional cross sectional

contour, in order to compare results with already existing trial and error solutions. An exact solution of the three dimensional complex wave equation is found. The evaluations show that consideration of the two dimensional cross sectional contour produces only a negligible gain in accuracy, as compared with the use of the approximation method. Measurements carried out correspond with the theoretical investigation and show that the saturation effects discussed are correctly understood. The analysis of a polarizator, using the complex orthogonal development allows a better interpretability, as compared with finite element method. ESA

N92-33896*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
RF MODULATED FIBER OPTIC SENSING SYSTEMS AND THEIR APPLICATIONS
Grigory Adamovsky and John G. Eustace (John Carroll Univ., Cleveland, OH.) 1992 7 p Proposed for presentation at the SPIE's International Symposium OE/Fibers 1992, Boston, MA, 8-11 Sep. 1992; sponsored by the International Society for Optical Engineering
(Grant NAG3-984; RTOP 505-62-50)
(NASA-TM-105801; E-7231; NAS 1.15:105801) Avail: CASI HC A02/MF A01

A fiber optic sensing system with an intensity sensor and a Radio Frequency (RF) modulated source was shown to have sensitivity and resolution much higher than a comparable system employing low modulating frequencies or DC mode of operation. Also the RF modulation with an appropriate configuration of the sensing system provides compensation for the unwanted intensity losses. The basic principles and applications of a fiber optic sensing system employing an RF modulated source are described. In addition the paper discusses various configurations of the system itself, its components, and modulation and detection schemes. Experimental data are also presented. Author

N92-33901*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Physics.
OPTICAL DISTRIBUTED SENSORS FOR FEEDBACK CONTROL: CHARACTERIZATION OF PHOTOREFRACTIVE RESONATOR Final Technical Report, 15 Jan. 1992 - 14 Jan. 1993
Guy Indebetouw and D. K. Lindner Sep. 1992 15 p
(Grant NAG1-1363)
(NASA-CR-190808; NAS 1.26:190808) Avail: CASI HC A03/MF A01

The aim of the project was to explore, define, and assess the possibilities of optical distributed sensing for feedback control. This type of sensor, which may have some impacts in the dynamic control of deformable structures and the monitoring of small displacements, can be divided into data acquisition, data processing, and control design. Analogue optical techniques, because they are noninvasive and afford massive parallelism may play a significant role in the acquisition and the preprocessing of the data for such a sensor. Assessing these possibilities was the aim of the first stage of this project. The scope of the proposed research was limited to: (1) the characterization of photorefractive resonators and the assessment of their possible use as a distributed optical processing element; and (2) the design of a control system utilizing signals from distributed sensors. The results include a numerical and experimental study of the resonator below threshold, an experimental study of the effect of the resonator's transverse confinement on its dynamics above threshold, a numerical study of the resonator above threshold using a modal expansion approach, and the experimental test of this model. A detailed account of each investigation, including methodology and analysis of the results are also included along with reprints of published and submitted papers. Author

N92-34120# New Mexico Univ., Albuquerque. Center for High Technology Materials.
OPTOELECTRONIC MATERIALS CENTER: A COLLABORATIVE PROGRAM INCLUDING UNIVERSITY OF NEW MEXICO, STANFORD UNIVERSITY, AND CALIFORNIA INSTITUTE OF TECHNOLOGY Quarterly Report, 30 Jun. - 30 Sep. 1991
S. R. Brueck 30 Jun. 1992 15 p
(Contract MDA972-90-C-0046)
(AD-A253125) Avail: CASI HC A03/MF A01

The Optoelectronic Materials Center is a collaborative program involving the University of New Mexico, Stanford University, and the California Institute of Technology. Sandia National Laboratories and MIT Lincoln Laboratory are also involved in this program under separate contract vehicles. This program emphasizes three main areas: diode-based visible sources, two-dimensional optical interconnects, and high-speed optoelectronics. Progress on individual tasks is very briefly discussed. Several of the tasks will impact more than one of the above areas. For simplicity, the tasks are arranged by institution in an order roughly determined by the above areas. GRA

N92-34142*# Parks (Robert E.), Tucson, AZ.
ASSESSMENT OF THE PRESENT NASA OPTICAL METROLOGY CAPABILITIES AND RECOMMENDATIONS FOR ESTABLISHING AN IN-HOUSE NASA OPTICAL METROLOGY GROUP Final Report, 18 Mar. - 8 Sep. 1992
Robert E. Parks 8 Sep. 1991 29 p
(NASA Order H-13027-D)
(NASA-CR-190704; NAS 1.26:190704) Avail: CASI HC A03/MF A01

An investigation into when it was first recognized that there was a deficiency in NASA optical metrology oversight capability, why this deficiency existed unnoticed for so long, and a proposal for correcting the problem is presented. It is explained why this optical metrology oversight is so critical to program success and at the same time, why it is difficult to establish due to the nature of the technology. The solution proposed is the establishment of an Optics Metrology Group within the NASA/MSFC Optics Branch with a line of authority from NASA S & MA. Author

N92-34241*# National Aeronautics and Space Administration. Pasadena Office, CA.
ALKALI METAL FOR ULTRAVIOLET BAND-PASS FILTER Patent Application
Nick Mardesich, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), George A. Fraschetti, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), Timothy McCann, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), Sherwood D. Mayall, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), Donald E. Dunn, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), and John T. Trauger, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 27 Aug. 1992 13 p
(Contract NAS7-918)
(NASA-Case-NPO-18433-1-CU; NAS 1.71:NPO-18433-1-CU; US-Patent-Appl-SN-936417) Avail: CASI HC A03/MF A01

An alkali metal filter having a layer of metallic bismuth deposited onto the alkali metal is provided. The metallic bismuth acts to stabilize the surface of the alkali metal to prevent substantial surface migration from occurring on the alkali metal, which may degrade optical characteristics of the filter. To this end, a layer of metallic bismuth is deposited by vapor deposition over the alkali metal to a depth of approximately 5 to 10 A. A complete alkali metal filter is described along with a method for fabricating the alkali metal filter. NASA

N92-33470# Bertin et Cie., Aix-les-Milles (France).
INTELLIGENT SENSORS AND FIBER OPTIC SENSOR NETWORKS [CAPTEURS INTELLIGENTS ET RESEAUX DE CAPTEURS A FIBRES OPTIQUES]
Jean-Pierre Volat *In* ESA, Telescience for Space Experimentation

in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 87-91 In FRENCH (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A01/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N92-33289# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
STUDIES OF RUNAWAY ELECTRON TRANSPORT IN TEXT
Pei-Wen Wang Dec. 1991 127 p
(Contract DE-AC02-78ET-51013)
(DE92-010767; DOE/ET-51013/T247; PFC/RR-91-19) Avail: CASI HC A07/MF A02

The transport of runaway electrons is studied by a plasma position shift experiment and by imposing an externally applied perturbing magnetic field on the edge. The perturbing magnetic field can produce either magnetic islands or, with overlapping islands, a stochastic field. Hard X-ray signals are then measured and compared with analytic and numerical model results. Diffusion coefficients in the edge, approximately 10(exp 4) sq cm/sec, and inside the plasma, approximately 10(exp 2) - 10(exp 3) sq cm/sec, are estimated. The averaged drift effects are small and the intrinsic magnetic fluctuations are estimated to be less than (b(sub r)/B(sub 0))(exp 2) greater than approximately 10(exp -10) at the edge and decreasing inward. Runaway electrons are a good diagnostic of the magnetic fluctuations. It is considered that the magnetic fluctuations have a negligible effect on electron thermal diffusion in the edge plasma. DOE

N92-33296# Department of Energy, Washington, DC. Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies.
MHD PROGRAM PLAN, FY 1992
Oct. 1991 34 p
(DE92-015976; DOE/FE-0259P) Avail: CASI HC A03/MF A01

The current MHD program being implemented is a result of a consensus established in public meetings held by the Department of Energy in 1984. Essential elements of the current program include the following: (1) develop technical and environmental data for the integrated MHD topping cycle system through POC testing (1,000 hours); (2) develop technical and environmental data for the integrated MHD bottoming cycle sub system through POC testing (4,000 hours); (3) design, construct, and operate a seed regeneration POC facility (SRPF) capable of processing spent seed materials from the MHD bottoming cycle; (4) prepare conceptual designs for a site specific MHD retrofit plant; and (5) continue system studies and supporting research necessary for system testing. The current MHD program continues to be directed toward coal fired power plant applications, both stand-alone and retrofit. Development of a plant should enhance the attractiveness of MHD for applications other than electrical power. MHD may find application in electrical energy intensive industries and in the defense sector. DOE

N92-33388# National Inst. for Fusion Science, Nagoya (Japan).
HELICAL DIVERTOR IN THE LARGE HELICAL DEVICE
N. Ohyabu, N. Noda, Hantao Ji, H. Akao (Nippon Electric Co. Ltd., Tokyo, Japan), K. Akaishi, T. Ono (Nagoya Univ., Japan), H. Kaneko, T. Kawamura, Y. Kubota, and S. Morimoto et al May 1992 21 p Submitted for publication
(NIFS-144) Avail: CASI HC A03/MF A01

The Large Helical Device (LHD), presently under construction, is a Heliotron/torsatron device with a closed divertor system. The edge LHD magnetic structure was studied in detail. A peculiar feature of the configuration is the existence of edge surface layers, a complicated three dimensional magnetic structure. However it does not seem to hamper the expected divertor functions. As a confinement improvement scheme for the LHD, we have proposed a high temperature divertor plasma operation in which a divertor plasma with a temperature of a few kev, generated by efficient pumping, leads to the confinement improvement. Conceptual designs of the LHD divertor components are under way. Author

N92-33389# National Inst. for Fusion Science, Nagoya (Japan).
EDGE PLASMA DENSITY RECONSTRUCTION FOR FAST MONOENERGETIC LITHIUM BEAM PROBING
S. Sasaki (Nagoya Univ., Japan), S. Takamura (Nagoya Univ., Japan), M. Ueda, H. Iguchi, J. Fujita, and K. Kadota (Nagoya Univ., Japan) May 1992 24 p Submitted for publication
(NIFS-147) Avail: CASI HC A03/MF A01

Two types of plasma density reconstruction methods for fast Li(sup 0) beam probe diagnostics were developed for edge profile measurements in the Compact Helical System device. In these methods, the density dependence of atomic processes such as ionization, excitation/deexcitation, and charge exchange is introduced by the use of effective rate coefficients that are calculated from the collisional radiative model.These methods enable us to get a plasma density profile well inside the last closed flux surface (LCFS) for a range of plasma densities, while considering attenuation of the fast Li(sup 0) beam and using effective rate coefficients. A new method (method-1) can unfold the plasma density profiles from a fractional part of the emission profile of the Li 1 resonance line. The second method (method-2) reconstructs the density profile from the whole range of emission profiles, including the signal tail-off region due to the beam attenuation. These two methods, which introduce the density dependence of atomic processes and the beam attenuation caused by ionization, noticeably improve the precision of the measurements and extend the measurements and extend the applicable density region of the plasma. Density profiles reconstructed by these two different methods have shown good agreement and are consistent with results from ruby laser Thomson scattering. Author

N92-33406# National Inst. for Fusion Science, Nagoya (Japan).
A MODEL OF MAJOR DISRUPTION IN TOKAMAKS
Kimitaka Itoh, Sanae-I. Itoh, Atsushi Fukuyama (Okayama Univ., Japan), Shunji Tsuji (Japan Atomic Energy Research Inst., Ibaraki.), and Allan J. Lichtenberg (California Univ., Berkeley.) May 1992 21 p Submitted for publication
(NIFS-146) Avail: CASI HC A03/MF A01

A mechanism for detecting the onset of the major disruption is proposed. The mechanism considers the effect of magnetic stochasticity on the growth of the m = 2 tearing mode. The toroidicity can cause stochasticity near the separatrix of the m = 2 magnetic island. This enhances the current viscosity and results in explosive growth. The threshold condition and the time scale of rapid growth are studied. Also, the role of the toroidal coupling to the m = 1 component is discussed. Author

N92-33408# National Inst. for Fusion Science, Nagoya (Japan).
HIGH-ETA HELICITY-INDUCED SHEAR ALFVEN EIGENMODES
N. Nakajima, C. Z. Cheng, and M. Okamoto May 1992 28 p Submitted for publication
(Contract DE-AC02-76CH-03073)
(NIFS-148) Avail: CASI HC A03/MF A01

The high-eta Helicity-induced shear Alfven Eigenmodes (HAE) are considered both analytically and numerically for a straight helical magnetic system, where eta is the toroidal mode number. The eigenmode equation for the high-eta HAE modes is derived along the field line and with the aid of the averaging method is shown to reduce to the Mathieu equation asymptotically. The discrete HAE modes are shown to exist inside the continuum spectrum gaps. The continuous spectrum gaps appear around omega(exp 2) = omega(sub A)(exp 2)(N(L(sub tau) - m)/2)(exp 2) for N= 1,2.., where omega(sub A) is the toroidal Alfven transit frequency, and l, m, and tau are the polarity of helical coils, the toroidal pitch number of helical coils, and the rotational transform, respectively. For the same omega(sub A) and tau, the frequency of the helical continuum gap is larger than that of the continuum

gap in tokamak plasmas by the absolute value of l - tau(exp -1)(m). The polarity of helical coils l plays a crucial role in determining the spectrum gaps and the properties of the high-eta HAE modes. The spectrum gaps near the magnetic axis are created by the helical ripple with circular flux surfaces for l = 1, and greater than or equal to 3 helicals. For l = 2 helical systems, the spectrum gaps are created by the ellipticity of the flux surfaces. These analytical results for the continuum gaps are created by the existence of the high-eta HAE modes in the continuum gaps are confirmed numerically for the l = 2 case, and we find that the HAE modes exist for mode structures with the even and the odd parties. Author

N92-33447# Argonne National Lab., IL.
SUMMARY OF RESULTS FROM THE TEXTOR HELIUM SELF-PUMPING EXPERIMENT
J. N. Brooks, A. Krauss, R. E. Nygren (Sandia National Labs., Albuquerque, NM.), B. L. Doyle (Sandia National Labs., Albuquerque, NM.), K. H. Dippel (Forschungszentrum Juelich G.m.b.H., Germany, F.R.), and K. H. Finken Mar. 1992 21 p Presented at the 10th International Conference on Plasma-Surface Interactions in Controlled Fusion Devices, Monterey, CA, 30 Mar. - 3 Apr. 1992
(Contracts W-31-109-eng-38; DE-AC04-76DP-00789)
(DE92-015185; ANL/CP-74780; CONF-920311-15) Avail: CASI HC A03/MF A01

Helium removal experiments were conducted in TEXTOR with a small helium self-pumping module located in a modified ALT-1 limiter head. The module contained two heated nickel alloy trapping plates, a nickel deposition filament array, a Langmuir probe, flux probe, and thermocouples. The experiment examined plasma helium removal via trapping of helium ions in the deposited nickel surfaces. Such helium removal was successfully observed, with about 10 percent of the helium He/D plasma being removed in an approximately 1 s period. The module was found to be compatible with overall tokamak operation with essentially no sputtered nickel entering the core plasma. The temperature rise on the ion-exposed inner trapping plate, during a plasma shot, is consistent with a nickel local sheath potential of approximately 3 kT(sub e). Post-tokamak test examination of the trapping plates shows helium atom concentrations in the deposited nickel consistent with the observed helium removal, and shows very small D concentrations. DOE

N92-33448# Stanford Linear Accelerator Center, CA.
INERTIALLY CONFINED FUSION USING HEAVY ION DRIVERS
W. B. Herrmannsfeldt, R. O. Bangerter (California Univ., Berkeley. Lawrence Berkeley Lab.), R. Bock (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.), W. J. Hogan (Lawrence Livermore National Lab., CA.), and John D. Lindl (Lawrence Livermore National Lab., CA.) Oct. 1991 22 p Presented at the 15th Congress of the World Energy Council: Energy and Life, Madrid (Spain), 20-25 Sep. 1992
(Contracts DE-AC03-76SF-00515; DE-AC03-76SF-00098; W-7405-eng-48)
(DE92-006439; SU-SLAC-PUB-5457; CONF-920906-1) Avail: CASI HC A03/MF A01

The various technical issues of HIF will be briefly reviewed in this paper. It will be seen that there are numerous areas in common in all the approaches to HIF. In the recent International Symposium on Heavy Ion Inertial Fusion, the attendees met in specialized workshop sessions to consider the needs for research in each area. Each of the workshop groups considered the key topics of this report: (1) feasibility of international collaboration on HIF; (2) problems identification; (3) relaxation of classification of target issues; (4) types of collaboration, bilateral or multilateral; and (5) funding problems associated with international collaboration. The authors of this report share the conviction that collaboration on a broad scale is mandatory for HIF to have the resources, both financial and personnel, to progress to a demonstration experiment. Ultimately it may be possible for a single driver with the energy, power, focusibility, and pulse shape to satisfy the needs of the international community for target physics research. Such a facility could service multiple experimental chambers with a variety of beam geometries and target concepts. DOE

N92-33493# Los Alamos National Lab., NM.
EXPERIMENTAL STUDIES OF LASER-ABLATED ZIRCONIUM CARBIDE PLASMA PLUMES: FUEL CORROSION DIAGNOSTIC DEVELOPMENT
P. J. Wantuck, D. P. Butt, and A. D. Sappey 1992 15 p Presented at the Nuclear Technologies for Space Exploration, Jackson, WY, 16-19 Aug. 1992
(Contract W-7405-eng-36)
(DE92-015148; LA-UR-92-1557; CONF-920803-7) Avail: CASI HC A03/MF A01

Understanding the corrosion behavior of nuclear fuel materials, such as refractory carbides, in a high temperature hydrogen environment is critical for several proposed nuclear thermal propulsion (NTP) concepts. Monitoring the fuel corrosion products is important not only for understanding corrosion characteristics, but to assess the performance of an actual, operating nuclear propulsion system as well. In this paper, we describe an experimental study initiated to develop, test, and subsequently utilize non-intrusive, laser-based diagnostics to characterize the gaseous product species which are expected to evolve during the exposure of representative fuel samples to hydrogen. Laser ablation is used to produce high temperature, vapor plumes from solid solution, uranium-free, zirconium carbide (ZrC) forms for probing by other laser diagnostic methods, predominantly laser-induced fluorescence (LIF). We discuss the laser ablation technique, results of plume emission measurements, as well as the use of planar LIF to image both the ZrC plumes and actual NTP fuel corrosion constituents. DOE

N92-33525# General Atomic Co., San Diego, CA.
ELM STUDIES ON DIII-D AND A COMPARISON TO ASDEX RESULTS
H. Zohm, T. H. Osborne, K. H. Burrell, M. S. Chu, P. Gohil, L. L. Lao, T. S. Taylor, A. D. Turnbull, E. J. Doyle, and D. N. Hill Apr. 1992 5 p Presented at the 14th International Conference on Plasma and 19th EPS Conference on Controlled Fusion and Plasma Physics, Innsbruck, Austria, 29 Jun. - 3 Jul. 1992
(Contracts DE-AC03-89ER-51114; W-7405-eng-48; DE-FG02-86ER-52126)
(DE92-013766; GA-A-20895; CONF-920610-2) Avail: CASI HC A01/MF A01

In previous analysis of Edge Localized Modes (ELMs), three different types of ELMs were observed in D3-D, whereas only one type of ELM has been found in ASDEX. The type 3 ELMs observed on D3-D are similar to the ELMs observed on ASDEX, whereas type 1 ELMs did not occur on ASDEX. ELMs are found to be MHD events of short duration (1 to 2 ms), which, on D3-D, may be followed by a transient L-mode phase. This compound event was not observed on ASDEX. A stability analysis of D3-D discharges indicates type 3 ELMs occur well below the ideal ballooning limit. Type 1 ELMs generally occur close to this limit; there are, however, indications they also occur in discharges in which the edge is in the connection region to the second stability regime. DOE

N92-33628# National Inst. for Fusion Science, Nagoya (Japan).
COUPLING TO THE LOWER HYBRID WAVES WITH THE MULTIJUNCTION GRILL
Kunizo Ohkubo and Kazunori Matsumoto (Toyama Prefectural Univ., Imizugun, Japan) May 1992 37 p Submitted for publication
(NIFS-145) Avail: CASI HC A03/MF A01

Coupling characteristics of the multijunction grill were studied theoretically and experimentally by using a multireflection method with the aid of scattering matrices not only at the junction plane but also at the grill mouth. The global reflection coefficients in the primary waveguide and secondary waveguides can be estimated from the vector sum of reflecting components caused by each reflection between two scattering planes. The experimental results

of scattering matrices and the global coupling agree well with calculated ones. It is shown that the multiple reflection in secondary waveguides of the four-junction grill for JIPPT-IIU tokamak is finished until three or four reflections. The length of the secondary waveguides is confirmed to be one of the parameters determining the grill efficiency. Author

N92-33743# National Inst. for Fusion Science, Nagoya (Japan).
SHAFRANOV SHIFT IN LOW-ASPECT-RATIO HELIOTRON/TORSATRON CHS
H. Yamada, K. Ida, H. Iguchi, K. Hanatani (Kyoto Univ., Uji, Japan), S. Morita, O. Kaneko, H. C. Howe (Oak Ridge National Lab., TN.), S. P. Hirshman (Oak Ridge National Lab., TN.), D. K. Lee (Oak Ridge National Lab., TN.), and H. Arimoto et al Sep. 1991 31 p
(NIFS-110) Avail: CASI HC A03/MF A01

The MHD equilibrium properties of neutral-beam-heated plasmas have been experimentally investigated in the Compact Helical System (CHS), a low-aspect-ratio (A(sub p) about 5) heliotron/torsatron. This configuration is characterized by a strong breaking of helical symmetry. The radial profiles measured by various diagnostics have shown significant Shafranov shift due to plasma pressure. The deviation of the magnetic axis from its vacuum position has reached 50 percent of the minor radius. When the three-dimensional equilibrium code VMEC is used to reconstruct the equilibrium from the experimental data, the result is in good agreement with the experimentally observed Shafranov shift as well as the diamagnetic pressure in plasmas with (beta) less than or equal to 1.2 percent and beta(sub 0) less or equal to 3.3 percent. This beta value corresponds to half of the conventional equilibrium beta limit defined by the Shafranov shift reaching a value of half of the minor radius. Although tangential neutral beam injection has caused pressure anisotropies p(sub parallel)/p(sub perpendicular) less than or equal to 3, the description of the equilibrium assuming isotropic pressure is consistent with the experiment. Author

N92-33821 California Univ., Los Angeles.
DYNAMICS AND INTERACTION OF PLASMA CURRENTS WITH LARGE SELF-MAGNETIC FIELDS AND THEIR RELAXATION TOWARD A FORCE-FREE CONFIGURATION Ph.D. Thesis
Hans Pfister 1991 272 p
Avail: Univ. Microfilms Order No. DA9129944

The dynamics of current channels with large self-generated magnetic fields in a background plasma and, in particular, their relaxation toward a force-free configuration is investigated. Relaxation, in the sense of the theoretical conception of Woltjer and Taylor, to configurations regarded as minimum energy states, described by the Beltrami equations J = mu sub 0 exp -1(tilde) x B = alpha(B), is reexamined in light of Salingaros' theoretical results. Detailed 3-D measurements in a quiescent laboratory plasma of 10 m length and 50 cm diameter yield the magnetic field B(x,y,z,t) and the plasma parameters, n(x,y,z,t), k(T sub e)(x,y,z,t) and V sub pl(x,y,z,t) at several thousand measurement locations. The plasma current J, plasma pressure p = nkT, pressure gradient force, tilde(p), and J x B force, are determined and relaxation toward a force-free configuration that includes pressure gradient forces, i.e., the validity of J x B = tilde(p), is tested. The temporal relaxation of a single current channel and the spatial relaxation of a dual current system is illustrated. A strong increase of alignment of the current density vector J and the total magnetic field B sub 0 + B sub self as a function of the distance from the plasma source is found. The return currents that prevent the two current channels from twisting about each other, after turn-off of the externally applied electric field, are identified and the conversion of the dual current system into a twin-axial system is shown.
Dissert. Abstr.

N92-33867# National Inst. for Fusion Science, Nagoya (Japan).
INTERNAL STRUCTURES OF SELF-ORGANIZED RELAXED STATES AND SELF-SIMILAR DECAY PHASE
Y. Kondoh (Gunma Univ., Japan) Mar. 1992 43 p Submitted for publication
(NIFS-141) Avail: CASI HC A03/MF A01

A thought analysis on relaxation due to nonlinear processes is presented to lead to a set of general thoughts applicable to general nonlinear dynamical systems for finding out internal structures of the self-organized relaxed state without using 'invariant'. Three applications of the set of general thoughts to energy relaxations in resistive MHD plasmas, incompressible viscous fluids, and incompressible viscous MHD fluids are shown to lead to the internal structures of the self-organized relaxed states. It is shown that all of the relaxed states in these three dynamical systems are followed by self-similar decay phase without significant change of the spatial structure. The well known relaxed state of Del times B = plus or minus lambda B is shown to be derived generally in the low beta plasma limit. Author

N92-33918# Lawrence Livermore National Lab., CA.
STEADY STATE ADVANCED TOKAMAK (SSAT): PRE-CONCEPTUAL DESIGN OF A SUPERCONDUCTING SSAT
K. I. Thomassen, ed. 11 Jun. 1992 218 p
(Contract W-7405-eng-48)
(DE92-015578; UCRL-ID-110394) Avail: CASI HC A10/MF A03

While the SSAT would be built primarily to explore advanced physics regimes in the steady state, doing so will have the added benefit of expanding our tokamak technology base. Key technology developments will be as follows: in disruption control; steady state power handling in the divertors, using materials that will survive their incident heat flux levels without serious erosion; low activation material usage to allow access to in-vessel and ex-vessel components during early phases of operation; and in remote maintenance techniques. There will be lesser but important developments in superconducting magnet technology, steady state auxiliary heating systems, steady state fueling and particle removal both from the plasma and from the machine, and in data acquisition and computing systems. These computing systems accommodate very long pulses and must be linked nationally through wide area networks that allow distributed computing, storage, and analysis of the data by the broad fusion community. In this paper the initial configuration and machine design are described. This description is provided at an early stage of pre-conceptual design in order to serve as a reference and to guide future choices and more detailed design work. It does not reflect final thinking in any particular subsystem but does characterize the issues well by presenting some solutions and giving numerical values to calibrate the various solutions, problems, and approaches described herein. DOE

N92-33919# Lawrence Livermore National Lab., CA.
X RAY SPECTROSCOPY OF LABORATORY PLASMAS
W. H. Goldstein May 1992 17 p Presented at the 10th International Colloquium on Ultra Violet and X Ray Spectroscopy of Astrophysical and Laboratory Plasmas, Berkeley, CA, 3-5 Feb. 1992
(Contract W-7405-eng-48)
(DE92-015821; UCRL-JC-109966; CONF-9202103-5) Avail: CASI HC A03/MF A01

A biased overview is presented of x-ray spectroscopy of laboratory plasmas through a discussion of four lines of experimental investigation that are extremely active. The topics discussed include the following: laser-produced plasmas, specifically spectroscopic modeling and diagnostics in the late-time recombining phase; low density plasma sources, including EBITs and Tokamaks, for the study of isolated-ion atomic processes, particularly indirect excitation mechanisms; absorption spectroscopy of x-ray heated plasmas, with application to the measurement of heavy element opacities; and, finally, ultrashort pulse laser-produced plasmas. The discussion of each plasma source and application emphasizes more-or-less the trend towards better control and/or independent measurement of conditions in the plasma, and the concomitant reduction in ambiguities of analysis and heightened leverage of spectroscopic investigation. The choice

of topics also reflects recent trends towards investigating systems of increasing complexity, including ionization transients and photoionized plasmas, near-solid and solid density plasmas, and the plasma spectroscopy of complex, heavy elements. DOE

N92-33955 Columbia Univ., New York, NY.
A NUMERICAL STUDY OF PLASMA EVOLUTIONS DUE TO RESISTIVE TEARING MODE TURBULENCE IN REVERSED-FIELD PINCHES (RFP'S) Ph.D. Thesis
Yu-Chun Kwok 1991 153 p
Avail: Univ. Microfilms Order No. DA9202695

Macroscopic transport in reversed-field pinches (RFP's) due to turbulent electric fields is studied by the method of numerical simulation in a straight toroidal cylinder. A turbulent electric field model of resistive magnetohydrodynamic (MHD) tearing modes is incorporated in the 1-D quasiequilibrium MHD equations to obtain the transport equations. Recent RFP experiments have shown that magnetic fields resisted ohmic dissipation after a screw pinch equilibrium, initially turbulent, evolved into an RFP state. The outstanding features, which lack complete theories regarding the underlying mechanisms, are the instantaneous reversal of toroidal magnetic field at the transition point and the sustainment of the RFP phase which follows two important physics issues in controlled thermonuclear fusion study. The objective is to examine, through a time-dependent calculation, the effects of resistive tearing mode turbulence on the RFP evolution and to explore the possibility of a dynamo action resulting from such activities in context of addressing the two issues. To alleviate a constraint imposed by the force-balance condition on the velocity variable, a Lagrangian mesh method in which the poloidal magnetic flux function serves as the spatial variable is used to integrate the set of the transport equations. Finite difference schemes are applied to obtain numerical solutions. The transport equations, scaled in some set of base units, can be parameterized by five adjustable numerical constants. These numbers measure, in simulation units, the ratio of E x B-drift to diffusion speed, the level of tearing mode turbulence, the applied electric field in toroidal and poloidal directions, and the position of the conducting shell relative to the plasma edge. Case studies in parameter space corresponding qualitatively to that of ZT-40(M) operations were carried out. Our findings show that while the turbulent electric field can provide a driving force on a short time-scale to account for the toroidal field self-reversal, studies on the evolution patterns on a longer time-scale have indicated that the effects of the tearing mode turbulence mimicked a hyper-resistivity term rather than that of a dynamo. This latter part of the conclusion, however, cannot be applied to an equilibrium which is already in a steady state and force-free, because the numerical evolution, posed as an initial-boundary value problem and modeled by the transport equations, have never reached a steady state nor become force-free in the simulation calculation. Dissert. Abstr.

N92-33962# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PREDICTION OF PERFORMANCE OF TWO-PHASE FLOW NOZZLE AND LIQUID METAL MAGNETOHYDRODYNAMIC (LMMHD) GENERATOR FOR NO SLIP CONDITION
G. Fabris and L. Back 1992 30 p Presented at the 27th Intersociety Energy Conversion Engineering Conference, San Diego, CA, 3-7 Aug. 1992 Submitted for publication
(Contract DE-AI01-86CE-90237)
(DE92-006768; CONF-920801-1) Avail: CASI HC A03/MF A01

Two-phase LMMHD energy conversion systems have potentially significant advantages over conventional systems such as higher thermal efficiency and substantial simplicity with lower capital and maintenance costs. Maintenance of low velocity slip is of importance for achieving high generator efficiency. A bubbly flow pattern ensures very low velocity slip. The full governing equations were written out, and a computer prediction code was developed to analyze performance of a two-phase flow LMMHD generator and nozzle under conditions of no slip. Three different shapes of a LMMHD generator has been investigated. Electrical power outputs are in the 20 kW range. Generator efficiency exceeds 71 percent at an average void fraction of about 70 percent. This is an appreciable performance for a short generator without insulating vanes for minimizing electrical losses in the end regions. DOE

N92-34001 Stanford Univ., CA.
NON-EQUILIBRIUM BEHAVIOR IN A FLOWING, ATMOSPHERIC PRESSURE PLASMA Ph.D. Thesis
Thomas Gerald Owano 1991 134 p
Avail: Univ. Microfilms Order No. DA9206834

A radio frequency inductively coupled plasma torch has been used to generate flowing atmospheric pressure plasmas. Maximum temperatures and electron densities of approximately 8500 K and 3 x 10(exp 15) cm(exp -3), respectively have been produced at the exit plane of the torch. Thermal, ionizational, and chemical non-equilibrium occurring as the plasma flows through a controlled reactor are studied. Emission spectroscopy of an argon plasma was performed to examine the thermodynamic and ionizational state of the plasma. Results show that the recombining plasma is in a state of partial-local thermodynamic equilibrium. A partial equilibrium model of the plasma is used to interpret measurements of the volumetric radiative source strength of argon in the temperature range from 5000 to 8500 K. A non-equilibrium computational model of the flowing argon plasma was written to simulate the evolution of the plasma state from the entrance of the reactor to its exit. By accurately modeling the non-equilibrium properties of the plasma, such as radiative losses, radiative transport, electron diffusion, thermal conductivity, and finite rate electron recombination, agreement between measured and modeled reactor exit conditions was achieved. The electron-ion three body recombination rate inferred from this comparison was found to be approximately three times larger than values previously reported in the literature. Chemical non-equilibrium in the boundary layer of a substrate placed in an argon-hydrogen-methane plasma was used to synthesize diamond particles and films on molybdenum and silicon substrates. A parametric study of substrate temperature and methane/hydrogen feed ratio was performed. It was found that the substrate temperature range over which diamond growth occurred shifted towards higher temperature as the methane/hydrogen feed ratio was increased. The growth rate was found to reach a maximum with varying methane/hydrogen ratio at a constant substrate temperature. This peak growth rate was observed to shift slightly towards a higher methane/hydrogen ratio with increasing substrate temperature. Raman analysis of the deposits indicates that higher quality, well faceted diamond is achieved at the highest limits of substrate temperature for a given methane/hydrogen feed ratio. Comparison of growth rates for a flat plate boundary layer geometry were made with a two-dimensional reacting boundary layer code. Dissert. Abstr.

N92-34010# General Atomic Co., San Diego, CA.
IMPURITY PENETRATION AND TRANSPORT DURING VH-MODE ON D3-D
S. I. Lippmann, T. E. Evans, G. L. Jackson, and W. P. West May 1992 18 p Presented at the 10th International Conference on Plasma-Surface Interactions in Controlled Fusion Devices, Monterey, CA, 30 Mar. - 3 Apr. 1992
(Contract DE-AC03-89ER-51114)
(DE92-014233; GA-A-20903; CONF-920311-13) Avail: CASI HC A03/MF A01

A new modeling effort is made in order to understand the observed relatively low levels of impurity contamination during the VH-mode phase on D3-D, as compared to those observed during the H-mode phase of selected discharges. The key element is the inclusion of the real 2-D flux surface geometry in the prediction of impurity penetration of sputtered atoms through the scrape-off layer into the core plasma. Of the elements which determine the impurity content in the plasma - sputtering yield, penetration, and core transport - the penetration through the scrape-off layer is found to be the most determinative factor. The low impurity content in VH-mode is attributed to the development of a scrape-off layer with higher density and temperature properties than those normally obtained in H-mode. DOE

N92-34012# General Atomic Co., San Diego, CA.
COMPARISON OF TRANSIENT AND STATIONARY NEUTRAL PRESSURE RESPONSE IN THE D3-D ADVANCED DIVERTOR
C. C. Klepper (Oak Ridge National Lab., TN.), J. T. Hogan (Oak Ridge National Lab., TN.), L. W. Owen (Oak Ridge National Lab., TN.), P. K. Mioduszewski (Oak Ridge National Lab., TN.), R. Maingi (North Carolina State Univ., Raleigh.), and D. N. Hill (Lawrence Livermore National Lab., CA.) May 1992 18 p Presented at the 10th International Conference on Plasma-Surface Interactions in Controlled Fusion Devices, Monterey, CA, 30 Mar. - 3 Apr. 1992
(Contracts DE-AC03-89ER-51114; DE-AC05-84OR-21400)
(DE92-014257; GA-A-20900; CONF-920311-11) Avail: CASI HC A03/MF A01

The D3-D divertor baffle system was designed to facilitate density control in long pulse H-mode discharges by removing a particle flux equal to the neutral beam fueling rate (approximately 20 Torr-1/s) with an approximately 1 mTorr neutral pressure under the baffle (p(sub 0)). Initial measurements of the baffle pressure indicated that p(sub 0) approximately 10 mTorr (without pumping or biasing), a value much in excess of that required for long pulse density control. Radial sweeps of the X-point position have been employed to determine the maximum p(sub 0), as well as to establish the dependence of this pressure on geometry. An estimate of the particle equilibration time for the baffle system has been made by studying the baffle pressure response to 'giant' ELM effects. 'Steady state' experiments in which the X-point position was fixed for approximately 2.5s have also been carried out and steady baffle pressures were observed. The scaling of baffle pressure with plasma parameters has been found to be similar under transient and 'steady state' conditions. Detailed modeling of these experiments with the B2, DEGAS, and WDIFFUSE (wall model) codes has been made. DOE

N92-34071# Los Alamos National Lab., NM.
DEUTERIUM-FIBER-INITIATED Z-PINCHES: SIMULATION COMPARED TO EXPERIMENT
P. Sheehey (California Univ., Los Angeles.), I. R. Lindemuth, R. H. Lovberg (California Univ., San Diego, La Jolla.), and R. A. Riley, Jr. (California Univ., San Diego, La Jolla.) 1992 7 p Presented at the 9th International Conference on High Power Particle Beams, Washington, DC, 25-29 May 1992
(Contract W-7405-eng-36)
(DE92-015140; LA-UR-92-1622; CONF-920515-14) Avail: CASI HC A02/MF A01

Deuterium-fiber-initiated Z-pinch experiments have been simulated using a two-dimensional resistive magnetohydrodynamic model which includes many important experimental details, such as 'cold-start' initial conditions, thermal conduction, radiation, actual discharge current vs. time, and grids of sufficient size and resolution to allow realistic development of the plasma. When the fiber becomes fully ionized (at a time depending on voltage ramp and fiber thickness), the simulations show rapidly developing m = 0 instabilities drive intense non-uniform heating and rapid expansion of the plasma column. Diagnostics generated from the simulation results, such as shadowgrams and interferograms, are in good agreement with experiment. Comparison of simulation-generated diagnostics with those from early experiments of this type suggests that shadowgram images of the plasma were misleading indicators of the stability and rate of expansion of the plasma column. Terms often left out of the fluid model, such as the Hall term and the viscous stress tensor, may be significant in the Z-pinch. Progress will be reported on the addition of such terms to the simulation. DOE

N92-34115# Lawrence Livermore National Lab., CA.
ELECTRON-CYCLOTRON CURRENT DRIVE IN THE TOKAMAK PHYSICS EXPERIMENT
Gary R. Smith, Arnold H. Kritz (Lehigh Univ., Bethlehem, PA.), and Shelden H. Radin (Lehigh Univ., Bethlehem, PA.) 27 Apr. 1992 6 p Presented at the Topical Conference Meeting on Radio Frequency Heating and Current Drive of Fusion Devices, Brussels, Belgium, 7-10 Jul. 1992 Submitted for publication
(Contracts W-7405-eng-48; DE-FG02-92ER-54141)
(DE92-016159; UCRL-JC-110565-Preprint; CONF-920717-3)
Avail: CASI HC A02/MF A01

Ray-tracking calculations provide estimates of the electron-cyclotron heating (ECH) power required to suppress tearing modes near the q = 2 surface in the Tokamak Physics Experiment. Effects of finite beam width and divergence are included, as are the effects of scattering of the ECH power by drift-wave turbulence. A frequency of about 120 GHz allows current drive on the small-R (high-B) portion of q = 2, while 80 GHz drives current on the large-R (low-B) portion. The higher frequency has the advantages of less sensitivity to wave and plasma parameters and of no trapped-electron degradation of current-drive efficiency. Less than 1 MW suffices to suppress tearing modes even with high turbulence levels. DOE

N92-34177*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TIME DOMAIN REFLECTOMETRY IN TIME VARIANT PLASMAS
Michael J. Scherner Sep. 1992 80 p
(RTOP 505-64-70-01)
(NASA-TM-104056; NAS 1.15:104056) Avail: CASI HC A05/MF A01

The effects of time-dependent electron density fluctuations on a synthesized time domain reflectometry response of a one-dimensional cold plasma sheath are considered. Numerical solutions of the Helmholtz wave equation, which describes the electric field of a normally incident plane wave in a specified static electron density profile, are used. A study of the effects of Doppler shifts resulting from moving density fluctuations in the electron density profile of the sheath is included. Varying electron density levels corrupt time domain and distance measurements. Reducing or modulating the electron density levels of a given electron density profile affects the time domain response of a plasma and results in motion of the turning point, and the effective motion has a significant effect on measuring electron density locations. Author

N92-34180# Naval Research Lab., Washington, DC.
DIFFUSION OF THE SELF MAGNETIC FIELDS OF AN ELECTRON BEAM THROUGH A RESISTIVE TOROIDAL CHAMBER Interim Report
D. Dialetis, S. J. Marsh, and C. A. Kapetanakos 16 Jul. 1992 65 p
(AD-A253339; NRL/MR/4795-92-6985) Avail: CASI HC A04/MF A01

We have studied the diffusion of the self magnetic field of a relativistic electron beam through a resistive toroidal chamber. In contrast with previous calculations, the solution is not limited near the minor axis of the torus. Under the assumptions of small aspect ratio, thin conducting wall, and to zero order in toroidal corrections, it was found that there are three characteristic times with which the magnetic field leaks out of the resistive torus. The computed fields were used to determine the beam centroid orbit during trapping that follows the beam injection in the NRL modified betatron accelerator. The predicted orbit is in very good agreement with the results of the experiment. GRA

N92-34185# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
NON-LOCAL THERMODYNAMIC EQUILIBRIUM IN LASER SUSTAINED PLASMAS Final Report, 16 Mar. 1991 - 16 Jun. 1992
D. Zerkle and H. Krier 16 Jun. 1992 208 p
(Grant AF-AFOSR-0274-89)
(AD-A253389; UILU-ND-92-4016) Avail: CASI HC A10/MF A03

An argon laser sustained plasma (LSP) at atmospheric pressure was studied spectroscopically and the existence of a non-local thermodynamic state was determined. The spectroscopic data consist of several argon neutral and ion line emissions used to spatially resolve electronic energy level population densities in each

plasma species. A hydrogen seed is added to the argon flow for the purpose of determining electron number density by Stark broadening analysis of the Balmer series alpha line. Neutral and ionic argon electronic excitation temperatures are calculated from the spectroscopic data. Electron and heavy particle kinetic temperatures are calculated through the use of an appropriate nonequilibrium model which includes multitemperature gas state, and ionization equations. The dominant nonequilibrium effect in this plasma is kinetic nonequilibrium where the electron kinetic temperature can be more than twice the heavy particle kinetic temperature in high laser power flux regions. It is found that a local thermodynamic equilibrium (LTE) analysis of an ion upper energy level population density leads to an excellent prediction of ion number density. This is determined by comparison of the ion number density to the electron number density calculated through the hydrogen Stark broadening analysis, and assuming low temperature quasi-neutrality. Boltzmann equilibrium in the ionic argon system is indicated. LTE analysis of a neutral argon upper energy level population density leads to a very poor prediction of electron number density, but a fairly accurate prediction of neutral number density. GRA

N92-34235# National Inst. for Fusion Science, Nagoya (Japan).
FLUCTUATION AND EDGE CURRENT SUSTAINMENT IN A REVERSED-FIELD-PINCH
H. Ji (Tokyo Univ., Japan), H. Toyama (Tokyo Univ., Japan), A. Fujisawa (Tokyo Univ., Japan), S. Shinohara (Tokyo Univ., Japan), and K. Miyamoto (Tokyo Univ., Japan) Feb. 1991 19 p Submitted for publication
(NIFS-135) Avail: CASI HC A03/MF A01

Simple Ohm's law eta(j sub parallel) = E(sub parallel) is not satisfied in an a/2 less than or approximately = r less than or = a region of the REPUTE-1 RFP plasma. Fluctuation-induced electric fields, such as (v(tilde) x B(tilde)), are not sufficient to account for eta(j sub parallel) - E(sub parallel) at the edge. It is implied that current-diffusions due to magnetic fluctuations, carried by fast electrons rather than bulk cold electrons, sustain the edge parallel equilibrium current. Author

N92-33460# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
ROLE OF THE TELESCIENCES IN THE STUDY OF NATURAL PLASMAS IN THE SOLAR SYSTEM
A. Roux *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 21-26 (For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

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Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N92-33257# Purdue Univ., West Lafayette, IN. School of Materials Engineering.
STUDY OF MULTICOMPONENT DIFFUSION AND TRANSPORT PHENOMENA
H. Sato 1992 5 p
(Contract DE-FG02-84ER-45133)
(DE92-015050; DOE/ER-45133/4) Avail: CASI HC A01/MF A01

A steady progress is being made in all areas of research proposed for this period. Indeed, exciting progress is now expected in the frequency dependence of ionic conductivity and in atomistic treatments of chemical diffusion based on the progress made in this period. A brief account of work done during this period is given. Topics include: application of the cluster variation method for the calculation of the percolation problem; atomistic treatments of chemical diffusion; frequency dependence of ionic conductivity; diffusion process in semiconductors; formalism of the path probability method; and theoretical aspects of mixed alkali effect. DOE

N92-33262# Oregon Univ., Eugene. Dept. of Chemistry.
THRESHOLD PHENOMENA IN NONLINEAR CURRENTS UPON METALLIZATION OF Si(001) Technical Report No. 4, May 1991 - May 1992
S. Arekat, S. D. Kevan, and G. L. Richmond 26 May 1992 16 p
(Contract N00014-89-J-1261)
(AD-A252255) Avail: CASI HC A02/MF A01

Using a novel combination of fundamental and harmonic polarizations, we have used optical second harmonic (SH) generation to probe the nonlinear currents induced parallel to the surface plane of a Si(001) crystal upon adsorption of Na, K, and Cs. For all three alkalis, we observed abrupt thresholds in SH intensity and relative SH phase shift at the same coverage of very nearly one-sixth of a monolayer. We speculate that these thresholds correspond to insulator-metal transitions, and that a recently-observed low-coverage (2 x 3) structure is a Mott-Hubbard-like insulator. GRA

N92-33264# Oregon Univ., Eugene. Dept. of Chemistry.
SURFACE DIPOLE AND ELECTRIC QUADRUPOLE CONTRIBUTIONS TO THE ANISOTROPIC SECOND HARMONIC GENERATION FROM NOBLE METAL SURFACES Technical Report No. 1, May 1991 - May 1992
D. A. Koos, V. L. Shannon, and G. L. Richmond 26 May 1992 20 p
(Contract N00014-89-J-1261)
(AD-A252254) Avail: CASI HC A02/MF A01

The azimuthal anisotropy in the optical second harmonic response from various crystal faces of Ag, Cu, and Au has been measured. Comparing the relative magnitudes of the isotropic and anisotropic signals indicates that the strong anisotropy observed from the (111) and (110) faces of noble metals can be assigned primarily to the dipolar surface response. This result contrasts to the case of Al single crystals where the anisotropy can be accounted for by the bulk quadrupole response. GRA

N92-33268# Argonne National Lab., IL.
INTRINSIC RESPONSE OF CRYSTALS TO PURE DILATATION
Jinghan Wang (Massachusetts Inst. of Tech., Cambridge.), S. Yip (Massachusetts Inst. of Tech., Cambridge.), S. Phillpot, and D. Wolf 1991 33 p Presented at the Fall Meeting of the Minerals, Metals and Materials Society of AIME and Materials Week of the American Society of Metals, Cincinnati, OH, 20-24 Oct. 1991
(Contract W-31-109-eng-38)
(DE92-016780; ANL/CP-76452; CONF-911003-27) Avail: CASI HC A03/MF A01

The response of an f.c.c. lattice with Lennard-Jones interaction under symmetric lattice extension has been studied by Monte Carlo simulation at several temperatures. The critical strain at which the crystal undergoes a structural change is found to be well predicted by the mechanical stability limit expressed in terms of either the elastic constants or the bulk modulus. At low temperature (reduced temperature T = 0.125), lattice decohesion is observed in the form of cleavage fracture, whereas at higher temperature (T = 0.3) the strained system deforms by cavitation with some degree of local plasticity. At still higher temperature (T = 0.5) the lattice undergoes homogeneous disordering with all the attendant characteristics of melting. DOE

N92-33274# Rice Univ., Houston, TX. Dept. of Chemistry.
GROWTH KINETICS OF (100), (110), AND (111) HOMOEPITAXIAL DIAMOND FILMS
C. J. Chu, R. H. Hauge, J. L. Margrave, and M. P. DEvelyn 29 Jun. 1992 10 p
(Contract N00014-91-J-1550)
(AD-A252854; TR-6) Avail: CASI HC A02/MF A01

Diamond film growth by chemical vapor deposition (CVD) has

burgeoned rapidly during the past decade, accompanied by considerable progress in fundamental understanding. Particular progress has been made in understanding chemistry taking place in the gas phase above the substrate and in identification of the precuror(s) primarily responsible for growth, but the details of reactions taking place on the growing surface are as yet unknown. However, despite the commercial importance of high growth rates and the potential for gaining insight into the details of the growth mechanism, only a handful of studies of the growth kinetics of polycrystalline diamond films have been reported. GRA

N92-33300# Rice Univ., Houston, TX. Dept. of Chemistry.
HYDROGEN-HALOGEN CHEMISTRY ON SEMICONDUCTOR SURFACES
Stephen M. Cohen, Terttu I. Hukka, and Mark P. DEvelyn 29 Jun. 1992 12 p
(Contract N00014-91-J-1550)
(AD-A252853; TR-8) Avail: CASI HC A03/MF A01

The chemistry of coadsorbed H and X (X-Cl, Br) on semiconductor surfaces is important in epitaxial growth of silicon from chlorosilanes and of SixGe(1-x) in hydrogenating/halogenating cycles in atomic layer epitaxy, and also provides an interesting model system, yet has received little attention to date. We have investigated the interaction of H, HCl, and HBr with Ge(100) by temperature-programmed desorption, and find that H2, HCl, and HBr each absorb with near-first-order kinetics near 570-580 K, and the GECL2 and GeBr2 desorb with second-order kinetics near 680 K and 710 K, respectively. Trends in the chemistry and kinetics can be rationalized by viewing the dimer atoms on clean Ge(100)-(2x1) as being linked by a strained double bond and adsorption, decomposition, and desorption as being analogous to addition, rearrangement, and elimination reactions of molecular germanium compounds. The near-first-order desorption kinetics are attributed to pairing on surface dimers induced by the pi bond on unoccupied dimers. We infer a pairing enthalpy for H+H (= the pi bond strength of dimerized Ge(100) surface atoms) of 4-5 kcal/mol. GRA

N92-33418# Washington State Univ., Pullman.
INTERSUBBAND TRANSITIONS IN QUANTUM-WELL HETEROSTRUCTURES WITH DELTA-DOPED BARRIERS Interim Report
Lakshmi N. Pandey and Thomas F. George Jul. 1992 15 p
(Contract N00014-90-J-1193)
(AD-A252849; WSU/92/87) Avail: CASI HC A03/MF A01

A single quantum well doped by a negative delta-function potential (delta-potential) in the barrier regions is analyzed in terms of the optical transitions in between subbands. The first two states of the quantum well do not change at all as a function of the strength of the 6-potential up to a certain value, whereas the third one gets lowered almost exponentially. An important point is that the S-potential brings a state from the continuum to the bound region. There is a range of the strength of the S-potential during which the transition energy from the first to second state decreases rapidly, and at a certain strength the first and second states disappear, and the third and fourth, which have been brought from the continuum, take their places. The oscillator strengths of the allowed transitions have a kind of oscillatory behavior in that range. GRA

N92-33435# Wright Lab., Wright-Patterson AFB, OH.
COMPUTER SIMULATION OF CYCLIC SILOXANE-BASED LIQUID CRYSTALS: MOLECULAR DYNAMICS AND X RAY SCATTERING Final Report, May - Aug. 1991
E. P. Socci, B. L. Farmer, R. Pachter, W. W. Adams, and T. J. Bunning Jan. 1992 60 p
(AD-A253051; WL-TR-91-4137) Avail: CASI HC A04/MF A01

The molecular dynamics technique is employed in the present study to investigate molecular models of a liquid crystal (LC) based on cyclic penta(methylsiloxane) with combinations of cholesteryl4'-allyloxybenzoate and biphenyl- 4'allyloxybenzoate mesogens, which is of technological importance because of attributes related to light processing media. The packing and structure exhibited by these commercially available cholesteric LC's show unusually well-defined interlayer order giving rise to high order x-ray reflections. The purpose of this investigation was to: (1) investigate the conformational flexibility of the molecular arrangements and organization of this cyclic siloxane-based LC at room temperature, providing insight into the relative stability of the various models proposed; and (2) serve as an instructional reference describing the basic theory and use of molecular mechanics and dynamics for the study of large molecular systems. Results from the molecular dynamics calculations indicate the degree of conformational flexibility among the pendant mesogens of this molecular system and its effects on interdigitation. In particular, the isolated disk model exhibits the most flexibility and greatest stability as indicated by mean dihedral angles and range for certain key torsions. The dynamics simulation of the cylinder pairs suggests a large conformational flexibility of the siloxane rings. Also, movements of the interdigitated mesogens were much higher for a fixed ring system than for the case where the ring atoms were free to move. X-ray scattering pattern calculations for the structures generated during the dynamics run demonstrate higher order than for the initial models. GRA

N92-33444# Oak Ridge National Lab., TN.
SCANNING TUNNELING MICROSCOPE STUDIES OF INITIAL EPITAXIAL GROWTH OF YBa2Cu3O(7-DELTA) THIN FILMS
Xiang-Yang Zheng (Tennessee Univ., Knoxville.), Shen Zhu (Tennessee Univ., Knoxville.), D. H. Lowndes, and R. J. Warmack Apr. 1992 6 p Presented at the Material Research Society Spring Meeting, San Francisco, CA, 27 Apr. - 2 May 1992
(Contract DE-AC05-84OR-21400)
(DE92-014135; CONF-920402-8) Avail: CASI HC A02/MF A01

The initial stage of epitaxial growth of laser ablated YBa2Cu3O(7-delta) (YBCO) thin films on (001) SrTiO3, LaAlO3, and MgO substrates, and on slightly miscut LaAlO3 and SrTiO3, were studied with scanning tunneling microscopy (STM). Surface images show that the initial YBCO growth mode can be either of the Stranski-Krastanov or the Volmer-Weber type, depending on the film-substrate lattice mismatch and the growth temperature. A small substrate miscut angle is found to strongly influence the growth mode of YBCO films. Screw dislocation-mediated growth is suppressed, and films grown at 800 C on (001) LaAlO3 substrates with miscut angle of 2.0 deg along the group of zone axes (100) or (110) directions were found to consist of tilted platelets that are epitaxially aligned with the substrate crystal lattice. DOE

N92-33490# Naval Surface Warfare Center, Silver Spring, MD.
PSEUDOPOTENTIAL BAND CALCULATIONS ALONG A HIGH-SYMMETRY AXIS. PART 2: SPIN-ORBIT INTERACTION AND THE (111) DIRECTION
D. Y. Agassi and J. B. Restorff 1 Jul. 1991 51 p
(AD-A252397; NAVSWC-TR-91-326) Avail: CASI HC A04/MF A01

A rapidly convergent method for band structure calculations, based on a cylindrical coordinates expansion, is generalized to include the spin-orbit interaction. This approach is advantageous particularly for materials highly anisotropic in one direction. The pertinent wave equations are tested for the PbSe low bands along the Tau-L line. The results compare well with PbSe known band structure except where the bands group together to form degenerate, or near degenerate, equal parity clusters. GRA

N92-33491# California Univ., Los Angeles.
AFM STUDY OF FILM GROWTH KINETICS IN HETEROEPITAXY Technical Report, 1 Jun. 1991 - 31 May 1992
W. M. Tong, E. J. Snyder, R. S. Williams, A. Yanase, and Y. Segawa 28 Apr. 1992 8 p
(Contract N00014-90-J-1178)
(AD-A252408; TR-17) Avail: CASI HC A02/MF A01

The growth of CuCl/CaF2 heterostructures was studied with an atomic force microscope (AFM). We have grown by molecular beam epitaxy (MBE) CuCl thin films at various substrate temperatures and thicknesses on CaF2(111) substrates. AFM

studies reveal that islanding is the dominant growth mechanism. We calculated the height-height correlation function, (Ih(q,t)12), for each of our films and compared them to the predictions made by the Shadowing Growth Theory, a preexisting growth model that enabled us to extract the important kinetic parameter of surface diffusion length for the growth condition of each of the four films. GRA

N92-33524# Sandia National Labs., Albuquerque, NM.
OPTICALLY INDUCED NITROGEN DANGLING-BONDS IN AMORPHOUS HYDROGENATED SILICON NITRIDE THIN FILMS
W. L. Warren, P. J. McWhorter, J. Kanicki (IBM Watson Research Center, Yorktown Heights, NY.), and E. H. Poindexter (Army Electronics Technology and Devices Lab., Fort Monmouth, NJ.) 1991 12 p Presented at the Electro Chemical Society (ECS) Meeting, St. Louis, MO, 17-22 May 1991
(Contract DE-AC04-76DP-00789)
(DE92-013660; SAND-91-2371C; CONF-9105342-1) Avail: CASI HC A03/MF A01

Using X-band and Q-band electron paramagnetic resonance (EPR) microwave frequencies, we have confirmed a model for the ultra-violet (UV) induced nitrogen dangling-bond in N-rich amorphous hydrogenated silicon nitride thin films. We also report for the first time that the UV-induced N dangling-bonds can be photo-bleached (light induced annealing) by sub-bandgap light. Since the photo-bleaching phenomenon is reversible, i.e., these defect centers can be reversibly photo-created or photo-bleached--a process requiring short vs. long-wave UV--without any change in the net space charge density of the films, it is suggested that an optical rearrangement of spin state and charge state of positive, negative, and neutral nitrogen sites occurs. This study has also shown that the N dangling-bond is an electrically active point defect in these thin films. DOE

N92-33534# Argonne National Lab., IL.
SINTERING OF BULK HIGH-(Tc) SUPERCONDUCTORS: Y-Ba-Cu-O
K. C. Goretta, N. Chen, M. T. Lanagan, W. Wu, J. P. Singh, R. A. Olson, J. L. Routbort, and R. B. Poeppel May 1992 9 p Presented at the 1992 Powder Metallurgy World Congress, San Francisco, CA, 21-26 Jun. 1992
(Contract W-31-109-eng-38)
(DE92-016190; ANL/CP-74238; CONF-9206195-1) Avail: CASI HC A02/MF A01

Sintering of bulk YBa2Cu3O(x) (123) samples was conducted from 850 to 1010 C in oxygen partial pressures (P(sub O2)) of 2.5(10)(exp 2) to 10(exp 5) Pa. The final grain sizes of the samples were controlled by selective use of liquid phases and by partial decomposition of the 123 phase by sintering in a P(sub O2) that was lower than the minimum needed for 123 stability. In nearly fully dense samples, it was found that the grain size could range from about 1 to 500 microns, depending on the processing conditions. DOE

N92-33550# Argonne National Lab., IL.
FLUX PINNING DEFECTS INDUCED BY ELECTRON IRRADIATION IN Y1Ba2Cu3O(7-DELTA) SINGLE CRYSTALS
J. Giapintzakis (Illinois Univ., Urbana.), W. C. Lee (Illinois Univ., Urbana.), J. P. Rice (Illinois Univ., Urbana.), D. M. Ginsberg (Illinois Univ., Urbana.), I. M. Robertson (Illinois Univ., Urbana.), M. A. Kirk, and R. Wheeler Jun. 1992 6 p Presented at the Material Research Society Spring Meeting, San Francisco, CA, 27 Apr. - 2 May 1992
(Contract W-31-109-eng-38)
(DE92-016773; ANL/CP-76499; CONF-920402-40) Avail: CASI HC A02/MF A01

Single crystals of R(1)Ba2Cu3O(7-delta), (R=Y, Eu, and Gd), have been irradiated with 0.4-1.0 MeV electrons in directions near the c-axis. An incident threshold electron energy for producing flux pinning defects has been found. In-situ TEM studies found no visible defects induced by electron irradiation. This means that point defects or small clusters (less than or equal to 20 A) are responsible for the extra pinning. A consistent interpretation of the data suggests that the most likely pinning defect is the displacement of a Cu atom from the CuO2 planes. DOE

N92-33591# National Research Council of Canada, Boucherville (Quebec). Industrial Materials Inst.
SYSTEMATIC STUDY OF THE INTERACTIONS BETWEEN VARIOUS SUBSTRATES AND AN Er-Ba-Cu-O SUPERCONDUCTOR DURING CRYSTALLIZATION. PART 3: SUBSTRATES OF TiC, TiO2, MgO, Mg(x)Ti(y)O(z), AND Mg(0.8)Ni(0.2)O [ETUDE SYSTEMATIQUE DES INTERACTIONS ENTRE DIVERS SUBSTRATS ET UN SUPRACONDUCTEUR ER-BA-CU-O AU COURS DE LA CRISTALLISATION. PARTIE 3: SUBSTRATS TIC, YIO2, MGO, MG(X)TI(Y)O(Z), AND MG(0,8)NI(0,2)O]
D. Dube, B. Arsenault, C. Gelinas, P. Lambert, and B. Champagne 29 Jun. 1992 28 p In FRENCH
(NRC-34369-Pt-3; IMI-92RT-23500-1352-G-Pt-3; CTN-92-60578)
Avail: CASI HC A03/MF A01

An experimental evaluation was performed on various ceramic substrates interlain between a high temperature Er-Ba-Cu-O superconductor coating and a nickel base. The substrates examined include the carbide TiC, TiO2 and MgO, intermediate compounds of the type Mg(x)Ti(y)O(z), and a mixed nickel-magnesium oxide. Results of these evaluations are presented, including metallographic analysis, microstructure of the interface region, and the transition temperatures that were determined. The overall results show that the form of the superconductor grains on the TiO2 and MgO substrates are generally elongate. A larger texture of the superconductor was not observed on the mixed oxide substrates. No Ti or Mg was detected in the superconductor grains crystallized on pure TiO2 or MgO. The adhesion of the superconductor was good only on MgO or the mixed Mg-Ni substrates. It appears that the presence of Ti in the compounds stimulates the formation of Ba(0.47)Ti(0.34)Er(0.17)O(x) in the form of fine needles at the interface, which leads to a detaching of the superconducting compound. The crystallization on TiO2 substrates does not appreciably reduce the critical transition temperature. CISTI

N92-33592# National Research Council of Canada, Boucherville (Quebec). Industrial Materials Inst.
SYSTEMATIC STUDY OF THE INTERACTIONS BETWEEN VARIOUS SUBSTRATES AND AN Er-Ba-Cu-O SUPERCONDUCTOR DURING CRYSTALLIZATION. PART 4: SUBSTRATES OF ZrO2(M(x)O(y)), (M=Y AND/OR Ca AND/OR Ti AND/OR Mg) [ETUDE SYSTEMATIQUE DES INTERACTIONS ENTRE DIVERS SUBSTRATS ET UN SUPRACONDUCTEUR ER-BA-CU-O AU COURS DE LA CRISTALLISATION. PARTIE 4: SUBSTRATS ZRO2(M(X)O(Y)), (M=Y ET/OU CA ET/OU TI ET/OU MG)]
D. Dube, B. Arsenault, C. Gelinas, P. Lambert, and B. Champagne 29 Jun. 1992 24 p In FRENCH
(NRC-34370-Pt-4; IMI-92RT-23500-1353-G-Pt-4; CTN-92-60579)
Avail: CASI HC A03/MF A01

An experimental evaluation was performed on various ceramic substrates interlain between a high temperature Er-Ba-Cu-O superconductor coating and a nickel base. The examined substrates consisted essentially of zirconium oxide stabilized with oxides of yttrium, magnesium, calcium, and titanium. The results of these evaluations are presented, including metallographic analysis, microstructure of the interface region, and the transition temperatures that were determined. The overall results show that the form of the superconductor crystallized on all the sintered ZrO2 substrates was generally equiaxial. Titanium, magnesium, or calcium was not detected in the superconductor grains after crystallization. The adhesion of the superconducting compound was good only for the dense ZrO2 substrate containing 3 percent MgO. The total lack of adhesion to the other substrates is attributed to the reaction between barium originating from the liquid phase and the ZrO2 grains. A strong correlation appears to exist between the fall in critical temperatures and crystallization on substrates containing magnesium. CISTI

N92-33593*# Clemson Univ., SC. Dept. of Ceramic Engineering.
SUPERCONDUCTIVITY DEVICES: COMMERCIAL USE OF SPACE Annual Report, 3 Jul. 1991 - 2 Jul. 1992
Gene Haertling, Chi-Shiung Hsi, and Guang Li 28 Aug. 1992 100 p
(Grant NAG1-1301)
(NASA-CR-190690; NAS 1.26:190690) Avail: CASI HC A05/MF A02

High T sub C superconducting thick film were prepared by a screen printing process. Y-based (YBa2Cu3O(7-x) superconducting thick film were printed on 211/Al2O3, SNT/Al2O3, and YSZ substrates. Because of poor adhesion of the superconductor thick films to 211/Al2O3 and SNT/Al2O3 substrates, relatively low T sub C and J sub C values were obtained from the films printed on these substrates. Critical temperatures (T sub C) of YBa2Cu3O(7-x) thick films deposited on 211/Al2O3 and SNT/Al2O3 substrates were about 80 K. The critical current densities (J sub C) of these films were less than 2 A/sq cm. Higher T sub C and J sub C YBa2Cu3O(7-x) thick films were printed on YSZ substrates. A YBa2Cu3O(7-x) thick film with T sub C=86.4 and J sub C= 50.4 A/sq cm was prepared by printing the film on YSZ substrate and firing at 990 C for 10 minutes. Multiple-lead samples were also prepared on the YSZ substrates. The multiple-lead samples showed lower T sub C and/or J sub C values than those of the plain samples. The electrical properties of YBa2Cu3O(7-x) thick films were determined by the microstructures of the films. The YBa2Cu3O(7-x) thick films printed on the YSZ substrates, which had the best properties among the films printed on the three different kinds of substrates, had the highest density and the best particle interconnection. The YBa2Cu3O(7-x) thick films with preferred orientation in (001) direction were obtained on the YSZ substrates. Cracks, which retard the properties of the films, were found from the films deposited on the YSZ substrates. Currently, a MSZ (Magnesium Stabilized Zirconia) substrate, which had higher thermal expansion coefficient than the YSZ substrate, is used as substrate for the YBa2Cu3O(7-x) thick film in order to eliminate the cracks on the film. Bi-based superconductor thick films were printed on polycrystalline MgO and YSZ substrates. Interactions between BSCCO thick films and the YSZ substrates were observed. Various buffer layer materials were applied onto the substrates in order to avoid the interactions between the BSCCO thick films and the ZrO2-based substrates. So far, a BSCCO printed on MgO substrate with T Sub C=89K was obtained. The J sub C of the film was lower than 0.1 A/sq cm by reason of poor interconnectivity of the BSCCO particles. Author

N92-33595# National Inst. of Standards and Technology, Gaithersburg, MD. Semiconductor Electronics Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: EVALUATING A CHIP, WAFER, OR LOT USING SUXES, SPICE, AND STAT2
J. C. Marshall and R. L. Mattis Apr. 1992 147 p
(PB92-191220; NIST/SP-400/90) Avail: CASI HC A07/MF A02;SOD HC

The computer procedure KEYS (linking software to analyze wafers) links SUXES (Stanford University extractor of model parameters), SPICE (a simulation program with integrated circuit emphasis), and STAT2. Given data points for individual devices, SUXES obtains the model parameters for SPICE. SPICE predicts the behavior of an individual device or an entire circuit. After analyzing each test chip on a wafer, STAT2 determines correlation coefficients and generates wafer maps of seleted parameters. The wafer maps are valuable to the designer, modeler, and process engineer. The entire package accomplishes the following: (1) standardization of the running SUXES and SPICE in an integrated mode; (2) simulation and plotting of the characteristic curves; (3) simulation and plotting of the results of an optional dynamic circuit (for example, a ring oscillator); (4) performance of steps 2 and 3 for every test chip on each wafer; (5) summarization of the results from each chip, each wafer, and the lot; (6) rank-ordering of the model parameters for each wafer according to their correlation coefficients with respect to chosen circuit parameters; and (7) generation of wafer maps of several quantities. A CMOS 19-stage ring oscillator is used to illustrate the capabilities of KEYS. Author

N92-33597# National Research Council of Canada, Boucherville (Quebec). Industrial Materials Inst.
SYSTEMATIC STUDY OF THE INTERACTIONS BETWEEN VARIOUS SUBSTRATES AND AN Er-Ba-Cu-O SUPERCONDUCTOR DURING CRYSTALLIZATION. PART 5: SUBSTRATES OF SiC, RE2BaCuO5 (RE = Y, Nd), BaMO3 (M = Tl, Zr, Sn), AND SrTiO3 [ETUDE SYSTEMATIQUE DES INTERACTIONS ENTRE DIVERS SUBSTRATS ET UN SUPRACONDUCTEUR ER-BA-CU-O AU COURS DE LA CRISTALLISATION. PARTIE 5: SUBSTRATS DE SiC, RE2BACUO5 (RE=Y, ND), BAMO3 (M=TI, ZR, SN), ET SRTIO3]
D. Dube, B. Arsenault, C. Gelinas, P. Lambert, and B. Champagne 29 Jun. 1992 26 p In FRENCH
(NRC-34371-Pt-5; IMI-92RT-23500-1354-G-Pt-5; CTN-92-60580) Avail: CASI HC A03/MF A01

An experimental evaluation was performed on various ceramic substrates interlain between a high temperature ErBa2Cu3O7 superconductor coating and a nickel base. The substrates examined include the titanate, stannate, and zirconate of barium; silicon carbide; and oxides of type 211 based on neodymium or yttrium. The results of these evaluations are presented, including metallographic analysis, microstructure of the interface region, and the transition temperatures that were determined. The overall results show that the form of superconductor grains crystallized on most of the substrates was generally non-oriented. Silicon showed little penetration into the superconducting compound during crystallization and the produced contamination did not reduce the critical transition temperature by very much. An interfacial swelling is typical of the substrates consisting of titanate and zirconate of barium, as well as strontium titanate. Those compounds also exhibited a tendency to expand during sintering in air. No adhesion between the superconducting compound and the substrates was noted. The transition temperature was generally elevated, except for barium stannate and titanate. CISTI

N92-33615*# Florida Inst. of Tech., Melbourne. Dept. of Physics and Space Sciences.
FURTHER IMPROVEMENTS IN PROGRAM TO CALCULATE ELECTRONIC PROPERTIES OF NARROW BAND GAP MATERIALS Final Report, 15 Jun. 1991 - 15 Jun. 1992
James D. Patterson 15 Sep. 1992 64 p
(Grant NAG8-781)
(NASA-CR-190751; NAS 1.26:190751) Avail: CASI HC A04/MF A01

The tasks that we have accomplished are discussed. An extra task was a calculation comparing electron mobilities in Mercury Manganese Telluride with Mercury Cadmium Telluride given in 1H. We then list the reports and papers produced and follow that with either abstracts or the papers themselves. In one key paper we obtain good results between experiment and theory in Mercury Zinc Telluride and also find it typically has mobilities competitive with Mercury Cadmium Telluride. In the Appendix we have a relatively complete set of references. Author

N92-33646# National Research Council of Canada, Boucherville (Quebec). Industrial Materials Inst.
MASS TRANSFER IN A ErBa2Cu3O7 PELLET PARTIALLY MELTED IN A THERMAL GRADIENT
D. Dube, B. Arsenault, C. Gelinas, and P. Lambert 23 Jul. 1992 18 p Sponsored by Canadian Space Agency
(NRC-33756; IMI-92AP-23500-1317-G; CTN-92-60574) Avail: CASI HC A03/MF A01

Melt texturing in thermal gradients promotes the crystallization of oriented RBa2Cu3O(x) grains which improves the critical current densities. However, the presence of high thermal gradients induces a transport of material that modifies the composition of the melt and disrupts the crystallization process. Material transfer

phenomena were examined by crystallizing a ErBa2Cu3O(x) pellet in a static thermal field. The influence of material transfer on the microstructure of textured pellets was studied. These microstructures indicate that the material is transferred mainly by micro-capillarity. It was also determined that the temperature of the characteristic ridge formed during crystallization was about 892 C +/- 10 C, which corresponds closely to the solidification of the binary and ternary eutectic temperatures. Author (CISTI)

N92-33652# National Research Council of Canada, Boucherville (Quebec). Industrial Materials Inst.
SYSTEMATIC STUDY OF THE INTERACTIONS BETWEEN VARIOUS SUBSTRATES AND AN Er-Ba-Cu-O SUPERCONDUCTOR DURING CRYSTALLIZATION. PART 1: WORK OBJECTIVE AND EXPERIMENTAL APPROACH [ETUDE SYSTEMATIQUE DES INTERACTIONS ENTRE DIVERS SUBSTRATS ET UN SUPRACONDUCTEUR ER-BA-CU-O AU COURS DE LA CRISTALLISATION. PARTIE 1: OBJECTIF DU TRAVAIL ET APPROCHE EXPERIMENTALE]
D. Dube, B. Arsenault, C. Gelinas, P. Lambert, and B. Champagne 26 Jun. 1992 14 p In FRENCH
(NRC-34367-Pt-1; IMI-92RT-23500-1350-G-Pt-1; CTN-92-60576) Avail: CASI HC A03/MF A01

A research project was designed to evaluate the effectiveness of various substrates placed between a high temperature superconducting coating on a nickel base. The experimental procedures used in this project are described, including the preparation of the superconducting ErBa2Cu3O(7-x) powder, choice of ceramic substrates and their kinds of thermal treatment, formation of the ceramic substrates, melt texturing cycle, characterization of the superconducting transition temperature after texturation, and form of presentation of the results. CISTI

N92-33654# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
INVESTIGATIONS OF SPIN GLASS BEHAVIOR BY REPRESENTATIVES OF CsMo(2+)Mo(3+)F6 TYPE MODIFIED PYROCHLORE Ph.D. Thesis [UNTERSUCHUNGEN ZUM SPINGLASVERHALTEN VON VERTRETERN DER MODIFIZIERTEN PYROCHLORE DES TYPS CSMO2+MO3+F6]
Bernd Meissner 1991 214 p In GERMAN
(ETN-92-92132) Avail: CASI HC A10/MF A03

Magnetization measurements were carried out on CsCoCrF6, CsNiCrF6, CsNiFeF6, and CsCoFeF6, and additional neutron scattering measurements were carried out in CsCoCrF6 and CsNiCrF6 in order to determine if these substances can or cannot be assigned to the spin glasses. All samples showed the same characteristic properties as the spin glasses, with regard to their magnetic behavior. Only small variations of the quantitative type were detected in the behavior of pulverized samples of CSNiFeF6. As a whole, spin glass behavior was demonstrated in the examined substances. ESA

N92-33655# National Research Council of Canada, Boucherville (Quebec). Industrial Materials Inst.
SYSTEMATIC STUDY OF THE INTERACTIONS BETWEEN VARIOUS SUBSTRATES AND AN Er-Ba-Cu-O SUPERCONDUCTOR DURING CRYSTALLIZATION. PART 2: SUBSTRATES OF BaCrCu(0.16)O(x) ON NIO AND CHROMATES OF BARIUM AND/OR COPPER AND/OR ERBIUM. COMPARISON WITH A NIO CONTROL SUBSTRATE [ETUDE SYSTEMATIQUE DES INTERACTIONS ENTRE DIVERS SUBSTRATS ET UN SUPRACONDUCTEUR ER-BA-CU-O AU COURS DE LA CRISTALLISATION. PARTIE 2: SUBSTRATS DE BACRCU(0.16)O(X) SUR NIO ET DE CHROMATES DE BARIUM ET/OU DE CUIVRE ET/OU D'ERBIUM. COMPARAISON AVEC UN SUBSTRAT TEMOIN de NIO]
D. Dube, B. Arsenault, C. Gelinas, P. Lambert, and B. Champagne 26 Jun. 1992 34 p In FRENCH
(NRC-34368-Pt-2; IMI-92RT-23500-1351-G-Pt-2; CTN-92-60577) Avail: CASI HC A03/MF A01

An experimental evaluation was performed on various ceramic substrates interlain between a high temperature Er-Ba-Cu-O superconductor coating and a nickel base. The substrates examined include chromates of barium, copper, and erbium, as well as nickel oxide and oxidized nickel coated with barium chromate. The results of these evaluations are presented, including metallographic analysis, microstructure of the interface region, and the transition temperatures that were determined. The overall results show that barium chromate layers do not effectively reduce diffusion of nickel toward the substrate. The adhesion of the superconducting compound was good for most of the substrates. The presence of a small amount of chromium did not cause an appreciable reduction in the critical transition temperature. CISTI

N92-33670# Rice Univ., Houston, TX. Dept. of Chemistry.
CHEMISTRY OF HYDROGEN ON DIAMOND (100)
Y. L. Yang, L. M. Ulvick, L. F. Sutcu, and M. P. DEvelyn 29 Jun. 1992 19 p
(Contract N00014-91-J-1550)
(AD-A252874; TR-10) Avail: CASI HC A03/MF A01

Hydrogen plays a crucial role in diamond film growth by chemical vapor deposition and is likely to be similarly critical to atomic layer epitaxy, yet the surface chemistry of hydrogen on diamond is only beginning to be understood. We have investigated the adsorption of hydrogen and deuterium on diamond (100) by temperature-programmed desorption and by infrared multiple-internal-reflection spectroscopy using a natural type 2a diamond internal reflection element. Complementary theoretical studies have been carried out using the empirical MM3 molecular mechanics force field, which has a demonstrated high degree of accuracy for many molecules despite computational simplicity. H2 desorption was observed with a peak temperature of approximately 1250 K and a peak shape suggestive of first-order kinetics. Assuming a preexponential factor of 10(exp 13) s(exp -1), the activation energy for desorption is estimated as approximately 80 kcal/mol. Infrared evidence was seen for the monohydride surface structure, with one hydrogen atom per surface carbon atom (delta(sub CD)) mode at 901 cm(exp -1). The MM3 calculations predict that the (2x1):H monohydride phase is the most stable thermodynamically and the dominant phase under typical chemical vapor deposition conditions. GRA

N92-33676# Institute of Electrical and Electronics Engineers, New York, NY.
EPITAXIAL MATERIALS AND IN-SITU PROCESSING FOR OPTOELECTRONIC DEVICES MEETING
31 Jul. 1991 162 p Meeting held in Newport Beach, CA, 29-31 Jul. 1991
(Contract N00014-91-J-1683)
(AD-A252877) Avail: CASI HC A08/MF A02

We hope that the meeting will stimulate discussions between the participants on a variety of topics of current scientific and technological importance. This meeting will be focused primarily on the synthesis, growth, processing, and characterization of epitaxial semiconductor materials for optoelectronic and photonic applications. Emphasis will be placed on all aspects of epitaxial growth of advanced, integrated or novel materials and device structures and on microfabrication, microcomponents, and advanced semiconductor processing for optoelectronic applications. GRA

N92-33703# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
TEMPERATURE DEPENDENCE OF LATTICE PARAMETERS OF ALPHA-ZIRCONIUM
R. A. Versaci and M. Ipohorski (Comision Nacional de Energia Atomica, Buenos Aires, Argentina) 1991 25 p
(DE92-628808; CNEA-500) Avail: CASI HC A03/MF A01

This work presents a brief review of X-ray and thermal expansion determination of lattice parameters for alpha-zirconium. Data reported by different authors cover almost all the field of existence of the hexagonal phase of Zirconium, from temperatures as low as 4.2 K up to about 1130 K, near the alpha to beta transformation temperature. Polynomial expressions based on a least squares fitting of experimental data are also presented. The expressions

obtained by Goldak et al. are considered to be the most complete. The influence of impurities on the lattice parameters is also discussed. DOE

N92-33715# Argonne National Lab., IL.
STRUCTURE AND FLUX PINNING PROPERTIES OF IRRADIATION DEFECTS IN YBa2Cu3O(7-x)
M. A. Kirk Jun. 1992 22 p Presented at the 3rd International Meeting on Critical Currents in High Tc Superconductors, Vienna, Austria, 22-24 Apr. 1992
(Contract W-31-109-eng-38)
(DE92-016739; ANL/CP-76500; CONF-920438-1) Avail: CASI HC A03/MF A01

We review our investigations of defects produced in YBa2Cu3O(7-x) by various forms of irradiation. The defect microstructure has been studied by transmission electron microscopy (TEM). Irradiation enhancements of flux pinning have been studied by SQUID magnetometry on single crystals. In many cases the same single crystals were used in both TEM and SQUID investigations. The primary atom recoil spectra for all the irradiations studied have been carefully calculated and used to correlate the TEM and magnetization results for the different types of irradiation. Correlation of annealing experiments, employing both TEM and SQUID measurements, among several types of irradiation has also yielded information on the different defect structures present. Defect densities, sizes and strain field anisotropies have been determined by TEM. Defect flux pinning anisotropies have been determined for two field orientations in twinned single crystals. The temperature dependences of the flux pinning have been measured. The maximum field of irreversibility at 70 K is shown to change markedly upon both neutron and proton irradiations in some crystals and not others. The defect structure, chemistry, and location in the unit cell has been determined in some cases. Some interaction with existing defect structure has been observed in proton and electron irradiations. The damage character and directionality has been determined in GeV ion irradiated crystals. DOE

N92-33730# Martin Marietta Space Systems, Inc., Denver, CO.
INSERTION DEMONSTRATIONS OF DIGITAL GALLIUM ARSENIDE. OBP-80 REPORT. VOLUME 1: CHIP SET SCHEMATICS Final Report
1992 842 p
(Contract N00014-89-C-2169)
(AD-A250886; MCR-92-974-Vol-1) Avail: CASI HC A99/MF A10

The OBP-80 is an Engineering Development Model (EDM) of a bit slice computer constructed by Martin Marietta Space Systems for the Naval Research Laboratory. The contract was performed in cooperation with the Defense Advanced Research Projects Agency technology insertion program for digital gallium arsenide. This system has been developed to demonstrate, in a laboratory environment, an architecture that can be used to perform advanced signal processing functions onboard a spacecraft. Primary emphasis is placed on the transfer of an existing CMOS architecture to a higher performance, more radiation tolerant technology of Gallium Arsenide. This volume provides the schematic data which was used to generate the physical design of all seven VLSI components used in the OBP-80 EDM. It also presents top level graphical representations of the seven components. GRA

N92-33731# Martin Marietta Space Systems, Inc., Denver, CO.
INSERTION DEMONSTRATIONS OF DIGITAL GALLIUM ARSENIDE. VOLUME 4: OBP-80 SOFTWARE MODEL Final Report
2 Mar. 1992 713 p
(Contract N00014-89-C-2169)
(AD-A250887; MCR-92-974-Vol-4) Avail: CASI HC A99/MF A06

Martin Marietta constructed SIMCPU, a component level modeling environment for the GaAs OBP design. The modeling environment is composed of Behavioral Language Models (BLM's) for each component, Mentor Graphics Quicksim tool, and software to couple them together. The resulting environment had two purposes: (1) to allow accurate, component-level timing simulations of the complete GaAs CPU to be run in a reasonable amount of time; and (2) to provide the basis for which the detailed transistor level chip design and simulation tasks were compared against the register transfer level simulator, CPUSIM. To accomplish these goals, the complete GaAs CPU simulation had to be driven by a microprogram which was running in CPUSIM. It also had to be capable of providing system level timing decisions. GRA

N92-33806# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physics.
POSITRON DIFFUSION AND SURFACE INTERACTIONS IN SOLIDS Ph.D. Thesis
E. Soininen 1992 147 p
(PB92-189828; ISBN-951-666-348-6; PH-181) Avail: CASI HC A07/MF A02

Positron diffusion in solids and interactions at solid surfaces have been experimentally studied using positron beams. The positron diffusion coefficients have been extracted at 20-1400 K in metals and at 130-1000 K in semiconductors. The theoretical prediction that positron diffusion is limited by scattering from longitudinal acoustic phonons is experimentally verified. In Si also optical phonons contribute to positron scattering at high temperatures and in GaAs polar-optical phonons are as important as acoustic phonons. The effect of ionized impurity scattering is demonstrated in heavily doped Si. Positron emission and Ps formation at metal surfaces are investigated. At clean negative workfunction surfaces the yields are strongly depleted at low temperatures, in accordance with wave mechanical reflection of the positron from the surface barrier. The elemental composition of the Ge surface was monitored using PAES and better surface sensitivity than by conventional electron-impact-induced Auger electron spectroscopy was attained. The positron beam technique was applied to study defects in epitaxial GaAs technique was applied to study defects in epitaxial GaAs layers on Si. Both vacancy and Si clusters are detected and their relations to the dislocation density and Si diffusion are established. Author

N92-33810# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
INFLUENCE OF INTERMEDIATE LAYERS AT THE INTERFACE ON THE BAND DISCONTINUITIES OF SEMICONDUCTOR HETEROSTRUCTURES Ph.D. Thesis [EINFLUSS VON ZWISCHENSCHICHTEN AN DER GRENZFLAECHE AUF DIE BANDDISKONTINUITAETEN VON HALBLEITERHETEROSTRUKTUREN]
Christiane Maierhofer 1991 170 p In GERMAN Sponsored by DFG and BMFT
(ETN-92-92139) Avail: CASI HC A08/MF A02

Semiconductor structures fabricated by means of molecular beam epitaxy are addressed. Valence band discontinuities are determined 'in situ,' by photoelectron spectroscopy, using synchrotron radiation. It is shown that the valence band offset can be modified in a range of 0.3 eV, using extremely thin intermediate layers of antimony, bismuth, and aluminum. An antimony intermediate layer allows impedance of interface reactions. The commutativity, the independency of valence band offset from the growth sequence of involved semiconductor materials, is demonstrated. The experimentally determined valence band discontinuities are successfully compared to the currently significant theoretical models. ESA

N92-33811# Technische Univ., Berlin (Germany, F.R.). Inst. fuer Festkoerperphysik.
POTENTIAL BARRIERS OF ANTIMONY AND BISMUTH LAYERS ON GaAs(110) AND InP(110) Ph.D. Thesis [POTENTIALBARRIEREN VON ANTIMON- UND BISMUTSCHICHTEN AUF GAAS(110) UND INP(110)]
Norbert Esser 1991 176 p In GERMAN
(ISBN-3-928495-02-X; ETN-92-92140) Avail: CASI HC A09/MF A02

Extensive investigations on the adsorption of antimony and

bismuth on GaAs (110) and InP (110) are presented. Possible correlations between the structure of antimony and bismuth layers in monolayer range and the band deformation by buckling in the semiconductor surface barrier are examined in order to explain contradictions in the interpretation of previous investigations. Auger electron spectroscopy, electron diffraction, and photoelectron spectroscopy with low energy X radiation are used. Light scattering in ultrahigh vacuum is used for optical characterization. The Electric Field Induced Raman Scattering (EFIRS) allows determination of the Schottky barrier gate in the semiconductor surface barrier. It is shown that the quantitative evaluation of EFIRS investigations is not significantly impaired by photosimulated processes. ESA

N92-33813# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.
ANALYTICAL DESCRIPTION OF THE DEGRADATION BEHAVIOR OF SUBMICROMETER MOS STRUCTURES BY HOT CHARGED PARTICLES: EXPERIMENTS, MODEL PRODUCTION, AND SIMULATION FOR CIRCUIT TECHNICAL APPLICATIONS Ph.D. Thesis [ANALYTISCHE BESCHREIBUNG DES DEGRADATIONSVERHALTENS VON SUBMIKROMETER-MOS-BAUELEMENTEN DURCH HEISSE LADUNGSTRAEGER: EXPERIMENTE, MODELLBILDUNG UND SIMULATION FUER SCHALTUNGSTECHNISCHE ANWENDUNGEN]
Qin Wang 1991 131 p In GERMAN
(ETN-92-92142) Avail: CASI HC A07/MF A02

The quantification of transistor degradation and the influence of transistor degradation on the circuit properties were considered, with regard to Metal Oxide Semiconductors (MOS). Models describing the characteristics of degradated transistors were developed. The time dependency of degradation and its quantitative description constituted the basic condition for lifetime determination. The degradation course showed a characteristic saturation behavior, for which no model exists. For p channel transistors, the degradation showed a logarithmic time dependency. A two dimensional model was developed, using the 'lucky electron' model and differential equation. A simple analytical description of the degradation course was derived from this model, which allowed an exact extrapolation of lifetime. ESA

N92-33887# California Univ., Berkeley. Lawrence Berkeley Lab.
PREPARATION AND CHARACTERIZATION OF LOW-DEFECT SURFACES Ph.D. Thesis
T. O. Robinson Dec. 1991 243 p
(Contract DE-AC03-76SF-00098)
(DE92-017105; LBL-31639) Avail: CASI HC A11/MF A03

Silver crystal surfaces with low defect densities were prepared electrochemically from aqueous solutions using capillary-growth techniques. These surfaces had low rates for the nucleation of new silver layers. The impedance of these inert silver/aqueous silver nitrate interfaces was used to determine silver adatom concentration and water dipole reorientation energetics. DOE

N92-33889# EG and G Energy Measurements, Inc., Goleta, CA.
MAGNETIC RESPONSE OF HIGH (Tc) SUPERCONDUCTORS TO X RAY RADIATION AND DETECTION OF X RAYS
J. Artuso, L. Franks, K. Hull, and O. G. Symko (Utah Univ., Salt Lake City.) 1992 6 p Presented at the SPIE International Symposium on Optical Applied Science and Engineering, San Diego, CA, 19-24 Jul. 1992
(Contract DE-AC08-88NV-10617)
(DE92-017377; EGG-10617-2150; CONF-920792-11) Avail: CASI HC A02/MF A01

Experimental results are presented on the effects of x-rays on superconducting samples of polycrystalline YBaCuO. The radiation effects are detected at 4.2 K by changes of the magnetization of the sample using a SQUID magnetometer. In the presence of ionizing radiation, the changes in magnetization correspond to release of trapped flux, fluxon destruction, and low frequency noise due to flux flow. DOE

N92-33915# Oxford Univ. (England). Dept. of Engineering Science.
THE STRESS FIELD DUE TO A STRAIGHT DISLOCATION NEAR AN INTERFACE
P. Kelly, D. A. Hills, and D. Nowell 1992 26 p
(OUEL-1909/92; ETN-92-92062) Avail: CASI HC A03/MF A01

The Green's functions, i.e., the state of stress at an arbitrary point due to a dislocation having a unit Berger's vector, for solution of plane crack problems, are stated. Attention is restricted to materials which are elastic isotropic. The solutions, derived from Airy stress functions, are given for a dislocation located as follows: in an infinite plane; outside a circular inclusion embedded in an elastically dissimilar infinite matrix; near the straight interface between two elastically dissimilar half planes; on the interface between two elastically dissimilar half planes; inside a circular inclusion embedded in an elastically dissimilar infinite matrix; on the boundary of a circular inclusion embedded in an elastically dissimilar infinite matrix. ESA

N92-33921# Rice Univ., Houston, TX. Dept. of Chemistry.
HOMOEPITAXIAL GROWTH RATE STUDIES ON DIAMOND (110), (111), AND (100) SURFACES IN A HOT-FILAMENT REACTOR
C. J. Chu, Benjamin J. Bai, Norma J. Komplin, Donald E. Patterson, and Mark P. DEvelyn 29 May 1992 8 p
(Contract N00014-91-J-1550)
(AD-A252870; TR-7) Avail: CASI HC A02/MF A01

Growth rates of homoepitaxial (110), (111), and (100) diamond films were experimentally determined, for the first time, in a hot filament reactor using methane and carbon tetrachloride as the carbon source. Methane concentrations from 0.07 percent to 1.03 percent in H2 were studied at a substrate temperature of 970 C. Growth rates were found to be crystal-face dependent with respect to methane concentration, being linear or first order for the (100) orientation, sublinear for (110), and sigmoidal for (111). The observed growth kinetics of (111) suggest the viability of an acetylene mechanism for (111), along with the methyl radical mechanism at methane concentrations above 0.73 percent. CCl4 concentrations from 0.06 percent to 0.69 percent in H2 were also investigated at a substrate temperature of 970 C. Growth rate behavior was similar to that of methane for all three crystal faces. The temperature dependence of the growth rates was also crystal-orientation dependent. At substrate temperatures above 730 C, growth rates are thought to be mainly transport limited, yielding effective activation energies of 8 +/- 3, 18 +/- 2, and 12 +/- 4 kcal/mol for (100), (110), and (111) orientations, respectively. At substrate temperatures below 730 C, growth rates are thought to be surface reaction rate-limited, with an overall effective activation energy of 50 +/- 19 kcal/mol for the three crystal-orientations studied. GRA

N92-33923# Rice Univ., Houston, TX. Dept. of Chemistry.
ATOMIC FORCE MICROSCOPY OF (100), (110), AND (111) HOMOEPITAXIAL DIAMOND FILMS
L. F. Sutcu, C. J. Chu, M. S. Thompson, R. H. Hauge, and J. L. Musgrave 29 May 1992 33 p
(Contract N00014-91-J-1550)
(AD-A252872; TR-4) Avail: CASI HC A03/MF A01

We present atomic force microscopy images of diamond films grown by chemical vapor deposition epitaxially on diamond (100), (110), and (111) substrates. The films were grown from 0.2 - 1.6 percent mixtures of CH4 and C2H2 in H2 in a hot-filament reactor at a total pressure of 25 Torr. The substrate and filament temperatures were held at 810 - 1000 C and 2000 - 2150 C, respectively. A (100)-oriented diamond film grown with 0.3 percent CH4 at a substrate temperature of 810 C was rough on the micron scale, exhibiting pyramidal features, terraces, and penetration twins, while films grown at higher substrate temperatures and hydrocarbon flow rates were smooth on the nm scale and showed evidence of a (2x1) reconstruction. A (110)-oriented film was very rough on the micron scale but nearly atomically smooth on the 0.5 - 5nm scale and exhibited local slopes higher than 40 deg with no evidence of faceting. A film grown on a diamond (111) substrate

underwent spontaneous fracture due to tensile stress and exhibited a roughness of approximately 10-50 nm on the approximately 100 nm lateral scale in regions far away from any cracks. The implications of the morphological features for diamond growth mechanisms are discussed. GRA

N92-33924# Rice Univ., Houston, TX. Dept. of Chemistry.
NOVEL METHOD FOR CHEMICAL VAPOR DEPOSITION AND ATOMIC LAYER EPITAXY USING RADICAL CHEMISTRY
T. I. Hukka, R. E. Rawles, and M. P. DEvelyn 29 Jun. 1992 17 p
(Contract N00014-91-J-1550)
(AD-A252873; TR-9) Avail: CASI HC A03/MF A01

A novel method for chemical vapor deposition and atomic layer epitaxy using radical precursors under high vacuum conditions is being developed. The combination of selectively-generated radicals and high vacuum is ideal for low-temperature growth: growth rates remain relatively high because activation energies for radical reactions are typically small, and contamination and segregation are minimized by keeping the surface 'capped' by adsorbed intermediates and working under ultraclean conditions. Fluorine atoms are generated by thermal dissociation in a hot tube and abstract hydrogen atoms from precursor molecules injected immediately downstream of the source, generating radicals with complete chemical specificity. Preliminary results on growth of diamond films using the new method are presented. GRA

N92-33943# North Carolina State Univ., Raleigh. Dept. of Materials Science and Engineering.
THE DEPOSITION OF MULTICOMPONENT FILMS FOR ELECTROOPTIC APPLICATIONS VIA A COMPUTER CONTROLLED DUAL ION BEAM SPUTTERING SYSTEM Final Technical Report, 1 Jul. 1988 - 31 Dec. 1991
Angus I. Kingon, Orlando Auciello, and Klaus J. Bachmann 31 Dec. 1991 78 p
(Contract N00014-88-K-0526)
(AD-A252218) Avail: CASI HC A05/MF A01

A summary of project accomplishments are presented. The following topics are covered: Deposition of Electrooptic Thin Films; High Resolution Imaging of Twin and Antiphase Domain Boundaries in Perovskite KNbO3 Thin Films; Microstructural Characterization of the Epitaxial (111) KNbO3 on (0001) Sapphire; Electro-optic Characterization of Ion Beam Sputter-Deposited KNbO3 Thin Films; and Optical Characterization of Potassium Niobate Thin Film Planar Waveguides. GRA

N92-33981# Argonne National Lab., IL.
GROWTH, PREPARATION, AND DIELECTRIC PROPERTIES OF MONODOMAIN SINGLE CRYSTAL PbTiO3
Z. Li, X. Z. Xu, X. H. Dai, D. J. Lam, and S. K. Chan May 1992 14 p Presented at the 1992 AUSTCERAM, Melbourne, Australia, 16-21 Aug. 1992
(Contract W-31-109-eng-38)
(DE92-017068; ANL/CP-75750; CONF-9208106-1) Avail: CASI HC A03/MF A01

A method is described for obtaining monodomain PbTiO3 single crystals with high electrical resistivity (10(exp 10)(omega)cm) and low dielectric frequency dispersion. The single crystals of PbTiO3 were grown by flux solution method. Space charge related defects, which result in the large dielectric frequency dispersion, were eliminated by heat treatments. Ninty degree domains were removed by applying a unidirectional compressive stress along the group of zone axes (100) crystallographic direction. The monodomain single crystals of PbTiO3 were identified by cross polarized light optical microscopy and by x-ray diffraction (rocking curve). The anisotropic dielectric constants of these high quality single crystals were measured as a function of temperature. The results differ from the data reported previously in the literature. DOE

N92-33983# Argonne National Lab., IL.
INFORMATION ON GRAIN BOUNDARY STRUCTURE IN NANOCRYSTALLINE Pd AND Cr FROM DIFFRACTION STUDIES
J. A. Eastman, L. J. Thompson, J. Satti, M. R. Fitzsimmons, A. C. Lawson, and R. A. Robinson Jun. 1992 11 p Presented at the 6th International Conference on Intergranular and Interphase Boundaries in Materials, Thessaloniki, Greece, 22-26 Jun. 1992
(Contract W-31-109-eng-38)
(DE92-017094; ANL/CP-76522; CONF-920670-3) Avail: CASI HC A03/MF A01

Comparisons of diffraction data from nanocrystalline and coarse-grained Pd samples indicate that grain boundaries in nanocrystalline Pd are reasonably ordered. Lattice parameter measurements show no significant grain boundary excess volume in nanocrystalline Pd; therefore, the reduced density typically observed in nanocrystalline Pd samples must be due to porosity. The lack of any significant change in both thermal expansion coefficients and average atomic vibrational amplitudes may indicate that rigid-body motions normal to grain boundaries in nanocrystalline Pd are severely constrained. Nanocrystalline Cr shows many similarities in behavior with nanocrystalline Pd, except that significantly more non-peak intensity is observed from a nanocrystalline Cr samples than from a coarse-grained Cr sample. Impurities may account for this behavior. DOE

N92-33984# Oak Ridge National Lab., TN.
SAGITTAL CRYSTAL FOCUSING OF UNDULATOR RADIATION WITH HIGH HEAT LOAD INCLINED CRYSTALS
G. E. Ice and C. J. Sparks 1992 8 p Presented at the SPIE International Symposium on Optical Applied Science and Engineering, San Diego, CA, 19-24 Jul. 1992
(Contract DE-AC05-84OR-21400)
(DE92-017165; CONF-920792-13) Avail: CASI HC A02/MF A01

Sagittal focusing of undulator radiation is shown to be compatible with the proposed inclined double-crystal monochromator geometry for heat load reduction. The focusing aberrations are found to be negligible for typical undulator-beam divergences over a range of magnifications from 1:2 to 6:1 and energies from 3 to 40 keV. The inclined geometry reduces the required signal sagittal curvature of the focusing crystal compared to focusing with conventional symmetric crystals; hence, focusing is possible at higher x-ray energies and with less anticlastic bending. In addition, anticlastic stiffening ribs project a smaller footprint to the beam so that the achievable focal spot size is potentially better than with conventional symmetrically cut crystals. DOE

N92-34013# Pacific Northwest Lab., Richland, WA.
TRANSIENT STRESS EVOLUTION AND CRYSTALLIZATION IN LASER-IRRADIATED AMORPHOUS TITANIA SOL-GEL FILMS
G. J. Exarhos, N. J. Hess, and S. Wood (Washington State Univ., Pullman.) Oct. 1991 13 p Presented at the SPIE International Society for Optical Engineering Meeting, Boulder, CO, 23-25 Oct. 1991
(Contract DE-AC06-76RL-01830)
(DE92-014266; PNL-SA-19889; CONF-911064-10) Avail: CASI HC A03/MF A01

Amorphous TiO2 sol-gel films are irreversibly transformed to a crystalline anatase phase when heated to temperatures in excess of 575 K or subjected to intense pulsed or CW laser irradiation. The laser-induced transformation is initiated as a result of impurity absorption and subsequent heating, and results in densification and relative changes in compressive stress of the film. Isothermally annealed films exhibit a decrease in compressive stress as crystallization proceeds while an increase in compressive stress followed by a decrease in stress is observed when crystallization is laser-induced. Raman spectroscopy has been used to characterize the crystallization ingrowth kinetics and is used in this work as a real time probe of both film temperature and localized stress which can be evaluated from shifts in lattice phonon frequencies measured in real time during laser irradiation. The laser not only induces the phase transformation but excites inelastic Raman scattering from which film stress and temperature can be estimated. A second approach for the determination of these parameters requires incorporation of a thin ruby film between the titania and silica substrate. Here, the wavelength shift of the

laser-induced ruby fluorescence can be used to quantify interfacial stress; the fluorescence lifetime measurements are used to determine temperature. The advantages and limitations of these techniques for evaluating transient stress and temperature evolution in thin titania films subjected to CW laser irradiation will be discussed. DOE

N92-34014# Oregon State Univ., Corvallis. Dept. of Physics.
INDIUM DOPANT/DEFECT COMPLEXES IN LIGHTLY-DOPED CERIA
Ruiping Wang, J. A. Gardner, W. E. Evenson (Brigham Young Univ., Provo, UT.), and J. A. Sommers (Teledyne Wah Chang, Albany, NY.) 1991 8 p Presented at the 93rd Annual Meeting and Exposition of the American Ceramic Society (ACerS), Cincinnati, OH, 28 Apr. - 2 May 1991
(Contract DE-FG06-85ER-45191)
(DE92-014329; DOE/ER-45191/18; CONF-910430-32) Avail: CASI HC A02/MF A01

Four well-defined indium-dopant/lattice-defect complexes and the non-complexed substitutional indium dopant have been observed by perturbed angular correlation (PAC) spectroscopy in cerium oxide. PAC is a nuclear hyperfine experimental method that detects interactions between a radioactive probe nucleus and nearby atoms. The magnitude and symmetry of those interactions provide a signature for the electromagnetic fields at the probe nucleus. These fields are produced by the arrangement of charges and magnetic moments in the near environment of the probe, so they provide a means of identifying defect structures. DOE

N92-34067# Oak Ridge National Lab., TN.
A COMPREHENSIVE REVIEW OF THE XRD DATA OF THE PRIMARY AND SECONDARY PHASES PRESENT IN THE BSCCO SUPERCONDUCTOR SYSTEM. PART 1: Ca-Sr-Cu OXIDES
B. J. Reardon (Alfred Univ., NY.) and C. R. Hubbard Jan. 1992 85 p
(Contract DE-AC05-84OR-21400)
(DE92-014931; ORNL/TM-11948-Pt-1) Avail: CASI HC A05/MF A01

X-ray powder patterns for the phases in the CaO-SrO-CuO ternary system, along with the corresponding crystal structures, were obtained from the literature and from the Powder Diffraction File (PDF). Available X-ray diffraction (XRD) patterns were compared with each other and, when possible, with a simulated pattern for each phase, yielding a recommended reference pattern. The simulated powder patterns presented here deal with the phases found within the (Ca, Sr)O, (Ca,Sr)2CuO3, (Ca,Sr)14Cu24O41, (Ca,Sr)CuO2, (Ca,Sr)Cu2O3, and (Ca,Sr)Cu2O2 solid solution series and are recommended for the PDF. DOE

N92-34072# Los Alamos National Lab., NM.
PHASE TRANSFORMATIONS IN SUPERCONDUCTING AND NON-SUPERCONDUCTING PEROVSKITES
T. E. Mitchell 1992 8 p Presented at the International Conference on Martensitic Transformations, Monterey, CA, 20-24 Jul. 1992
(Contract W-7405-eng-36)
(DE92-015144; LA-UR-92-1583; CONF-920722-2) Avail: CASI HC A02/MF A01

Most of the high T(sub c) superconductors and other perovskite-related cuprates exhibit some kind of structural instability. For example, tetragonal-to-orthorhombic phase transformations occur in the Y-Ba-Cu-O and La-Sr-Cu-O systems while crystal structures in the Bi-Ca-Sr-Cu-O and Tl-Ba-Ca-Cu-O systems have incommensurate periodicities associated with displacements of the heavy cations. In YBa2Cu3O (7-delta), the transformation is due to the ordering of oxygen vacancies while in La(2-x)Sr(x)CuO4 the transformation is accompanied by tilting of the (CuO6) octahedra. Such tilting and distortion of the co-ordination octahedra commonly occur in perovskite-related compounds and transformations between the structures are frequently martensitic. Phase transformations in the superconducting cuprates were investigated by transmission electron microscopy but none of them appear to be martensitic. The phase transformations are accompanied by twinning and the resulting configurations are used to calculate twin boundary energies. DOE

N92-34084# Oak Ridge National Lab., TN.
FLUX CREEP STUDIES IN Y1Ba2Cu3O(7-DELTA) SUPERCONDUCTORS
Yang Ren Sun (Tennessee Univ., Knoxville.), Y. J. Chen (Tennessee Univ., Knoxville.), J. G. Ossandon (Tennessee Univ., Knoxville.), J. R. Thompson (Tennessee Univ., Knoxville.), and D. K. Christen 1992 7 p Presented at the Beijing International Conference on High-Tc Superconductivity, Beijing (China), 25-29 May 1992
(Contract DE-AC05-84OR-21400)
(DE92-014874; CONF-920526-1) Avail: CASI HC A02/MF A01

Magnetic relaxation studies, extending from the short term transient period to several days duration, have been conducted on in a high-J(sub c), proton irradiated Y1Ba2Cu3O(7-delta) single crystal and a melt-texture-growth Y1Ba2Cu3O(7-delta) sample. Long term flux creep measurements, as long as 3.5(10)(exp 5) s, revealed that the time dependent magnetization M(t) deviates significantly from a logarithmic decay, for a wide range of temperatures and magnetic fields. These experimental results can be analyzed using several models, including results from vortex-glass/collective pinning theory, a power law model, a form given by Griessen, and a double logarithmic expression, all with similar quality. In complementary experimental studies, the early stages of magnetic relaxation were probed by studying the effects of field sweep rate K = (partial derivative of) H/(partial derivative of) t on magnetization hysteresis loops M(H) with K ranging from 4 G/s to 1000 G/s. The dependence of M on K could also be fitted fairly well to each of these models, but the fitting parameters differ from those obtained in the long term relaxation measurements. Only the vortex glass/collective pinning theory gave consistent parameters for the two independent experiments. Thus we find that while the other forms can describe the decay of J in a limited time domain, the one model is accurate over a time window of 6 decades and is therefore favored. The effective hopping time for a vortex bundle, t(sub eff), is found to be approximately 0.1 s. DOE

N92-34121# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
NOVEL CHARGE INTEGRATING PULSED I(V) TECHNIQUE: A MEASUREMENT OF FOWLER-NORDHEIM CURRENTS THROUGH THIN SiO2 FILMS
J. C. Polar, W. S. Woodward, and E. A. Irene 13 Jul. 1992 29 p
(Contract N00014-89-J-1178)
(AD-A253144; TR-49) Avail: CASI HC A03/MF A01

The design, characterization and applications of a novel charge integrating pulsed current-voltage I(V) measurement are described. Tunneling transport through thin metal-oxide-semiconductor (MOS) capacitors is measured over ten orders of magnitude of current. Short pulse widths (less than 1 microsec) allow electrical characterization of these films under high current densities, without significant charge injection. A study of the quantum interference of electrons during Fowler-Nordheim (FN) conduction, is used to illustrate the measurement. GRA

N92-34124# Washington State Univ., Pullman.
TEMPERATURE VARIATION OF THE ELEMENTARY EXCITATION SPECTRUM OF THIN LIQUID He-4 FILMS Interim Report
Chung-In Um, Sang-Tahk Nam, Soo-Young Lee, and Thomas F. George Jul. 1992 56 p
(Contract N00014-90-J-1193)
(AD-A253416; WSU/92/88) Avail: CASI HC A04/MF A01

The temperature variation of the elementary excitation spectrum of thin liquid He-4 films is derived within the ring diagram approximation. This theory is microscopic only in the long wavelength limit. Using this anomalous spectrum, the specific heat

data adsorbed on Grafoil graphite and the first, second and third sounds are analyzed. The temperature variation of the phonon spectrum is very negligible for low temperatures. However, with increasing temperature from 0.6 - 0.7 K to near the vicinity of the two-dimensional transition temperature of 1.21 K, the temperature effect is significant regarding the physical properties of thin liquid He-4 films. GRA

N92-34127# California Univ., Santa Barbara. Dept. of Electrical and Computer Engineering.
QUANTUM WELL WIRES AND BOXES SUPERSTRUCTURES: MICROPROCESSING AND CHARACTERIZATION Final Report, 15 Aug. 1988 - 14 Aug. 1991
P. M. Petroff 14 Aug. 1991 15 p
(Grant AF-AFOSR-0334-88)
(AD-A253435; AFOSR-92-0681TR) Avail: CASI HC A02/MF A01

The research was aimed at producing quantum wire superlattices with dimensions below 10 nm by directly using molecular beam epitaxy. Two and three dimensional carrier confinement is achievable relatively easily when the confinement length scale is larger than 100 nm. This is the dimensional range of the so called mesoscopic devices. All the technologies which permit this mesoscopic regime are based on lithography (electrons or ions) processing which will be used for producing a depletion layer or a lateral band gap modulation with a strain field. Unfortunately the interesting effects associated with the presence of a superlattice and quantization are not found until the structure dimensions are well below the 50 nm range. There are presently few processing techniques which will permit reaching these dimensions. GRA

N92-34170*# Alabama Univ., Huntsville. Center for Microgravity and Materials Research.
FNAS/ADVANCED PROTEIN CRYSTAL GROWTH Final Report, 11 Mar. 1991 - 10 Sep. 1992
Franz Rosenberger 10 Sep. 1992 29 p
(Grant NAG8-868)
(NASA-CR-190910; NAS 1.26:190910) Avail: CASI HC A03/MF A01

A scintillation method is presented for determination of the temperature dependence of the solubility, S(T), of proteins in 50-100 micro-l volumes of solution. S(T) data for lysozyme and horse serum albumin were obtained for various combinations of pH and precipitant concentrations. The resulting kinetics and equilibrium information was used for dynamic control, that is the separation of nucleation and growth stages in protein crystallization. Individual lysozyme and horse serum albumin crystals were grown in 15-20 micro-l solution volumes contained in x-ray capillaries. Author

N92-34171* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
PROTEIN CRYSTAL GROWTH TRAY ASSEMBLY Patent
Daniel C. Carter, inventor (to NASA) and Teresa Y. Miller, inventor (to NASA) 14 Jul. 1992 6 p Filed 23 Oct. 1990 Supersedes N91-23933 (29 - 15, p 2514)
(NASA-Case-MFS-28507-1; US-Patent-5,130,105; US-Patent-Appl-SN-601954; US-Patent-Class-422-245; US-Patent-Class-422-254; US-Patent-Class-422-56; US-Patent-Class-422-99; US-Patent-Class-422-102; US-Patent-Class-156-600; US-Patent-Class-156-621) Avail: US Patent and Trademark Office

A protein crystal growth tray assembly includes a tray that has a plurality of individual crystal growth chambers. Each chamber has a movable pedestal which carries a protein crystal growth compartment at an upper end. The several pedestals for each tray assembly are ganged together for concurrent movement so that the solutions in the various pedestal growth compartments can be separated from the solutions in the tray's growth chambers until the experiment is to be activated.
Official Gazette of the U.S. Patent and Trademark Office

N92-34183# Aerospace Corp., El Segundo, CA. Technology Operations.
DAMAGE MODES AND MECHANISMS OF Si-Ge FILMS UNDER PROMPT SOFT X RAY RADIATION
S. R. Gyetvay, D. J. Chang, and R. Muki 13 May 1992 20 p
(Contract F04701-88-C-0089)
(AD-A253383; TR-92(2935)-2; SSD-TR-92-11) Avail: CASI HC A03/MF A01

Thermal and residual stresses in films exposed to sudden temperature changes are analyzed based on an elastoplastic-brittle idealization of film response. The results thus obtained are used to explain qualitatively the damage mechanisms of various failure modes observed in Si-Ge film deposited on a single crystal Si substrate exposed to soft x-ray radiation for a short duration of time. GRA

N92-34238# California Univ., Berkeley. Lawrence Berkeley Lab.
INVESTIGATION OF ULTRAFAST PHOTOTHERMAL SURFACE EXPANSION AND DIFFUSIVITY IN GaAs VIA LASER-INDUCED DYNAMIC GRATINGS Ph.D. Thesis
D. M. Pennington Apr. 1992 163 p
(Contract DE-AC03-76SF-00098)
(DE92-017112; LBL-32383) Avail: CASI HC A08/MF A02

This thesis details the first direct ultrafast measurements of the dynamic thermal expansion of a surface and the temperature dependent surface thermal diffusivity using a two-color reflection transient grating technique. Studies were performed on p-type, n-type, and undoped GaAs(100) samples over a wide range of temperatures. By utilizing a 90 fs ultraviolet probe with visible excitation beams, the effects of interband saturation and carrier dynamics become negligible; thus lattice expansion due to heating and subsequent contraction caused by cooling provided the dominant influence on the probe. At room temperature a rise due to thermal expansion was observed, corresponding to a maximum net displacement of approximately 1 Angstrom at 32 ps. The diffracted signal was composed of two components, thermal expansion of the surface and heat flow away from the surface, thus allowing a determination of the rate of expansion as well as the surface thermal diffusivity, D(sub S). By varying the fringe spacing of the grating, this technique has the potential to separate the signal contributions to the expansion of the lattice in the perpendicular and parallel directions. In the data presented here a large fringe spacing was used, thus the dominant contribution to the rising edge of the signal was expansion perpendicular to the surface. Comparison of the results with a straightforward thermal model yields good agreement over a range of temperatures (20-300 K). Values for D(sub S) in GaAs were measured and found to be in reasonable agreement with bulk values above 50 K. Below 50 K, D(sub S) were determined to be up to an order of magnitude slower than the bulk diffusivity due to increased phonon boundary scattering. The applicability and advantages of the TG technique for studying photothermal and photoacoustic phenomena are discussed. DOE

N92-33864# Fujitsu Ltd., Tokyo (Japan).
RESULT OF EXPERIMENTS BY GAS (GET AWAY SPECIAL): SEMICONDUCTOR CRYSTAL GROWTH EXPERIMENT IN MICROGRAVITY USING GAS PROGRAM
Shigeo Kodama, Kinji Nishio, Masahiro Takayanagi, Hiroshi Nemoto, Shinichi Kitamura, Yuuichi Suzuki, Osamu Ueda, Osamu Ootsuki, and Ken Kotani *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 147-159 In JAPANESE (For primary document see N92-33854 24-12)
Avail: CASI HC A03/MF A02

N92-33865# Tokyo Univ. (Japan). Dept. of Electronic Engineering.
STATUS OF INTERNATIONAL CO-OPERATION. CASE STUDY: ELUCIDATION OF THE CAUSE AND CONTROL OF SECOND IMPURITY PATTERN IN SEMICONDUCTORS [KOKUSAI KYOURYOKU NI YORU JIKKEN SEIKA. KESU SUTADI: HANDOUTAI NI OKERU DAI 2 SHU FUJUNBUTSUJIMA NO KEISEI GENIN NO KAIMEI TO YOKUSEI]
Tatau Nishinaga *In* Science and Technology Agency, The 14th Space Station Utilization Workshop in Japan 21 Jan. 1992 p 161-168 In JAPANESE Prepared in cooperation with Freiburg Univ., Fed. Republic of Germany (For primary document see N92-33854 24-12)
Avail: CASI HC A02/MF A02

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N92-33442# Texas Univ., Austin. Inst. for Fusion Studies.
DIELECTRIC ENERGY VERSUS PLASMA ENERGY, AND HAMILTONIAN ACTION-ANGLE VARIABLES FOR THE VLASOV EQUATION
P. J. Morrison and D. Pfirsch (Max-Planck-Inst. fuer Plasmaphysik, Garching, Germany, F.R.) Apr. 1992 52 p
(Contract DE-FG05-80ET-53088)
(DE92-014034; DOE/ET-53088/547; IFSR-545) Avail: CASI HC A04/MF A01

Expressions for the energy content of one-dimensional electrostatic perturbations about homogeneous equilibria are revisited. The well-known dielectric energy, epsilon(sub D), is compared with the exact plasma free energy expression, delta(exp 2)F, that is conserved by the Vlasov-Poisson system. The former is an expression in terms of the perturbed electric field amplitude, while the latter is determined by a generating function, which describes perturbations of the distribution function that respect the important constraint of dynamical accessibility of the system. Thus the comparison requires solving the Vlasov equation for such a perturbation of the distribution function in terms of the electric field. This is done for neutral modes of oscillation that occur for equilibria with stationary inflection points, and it is seen that for these special modes delta(exp 2)F = epsilon(sub D). In the case of unstable and corresponding damped modes it is seen that delta(exp 2)F does not equal epsilon(sub D); in fact delta(sup 2)F is equivalent to 0. This failure of the dielectric energy expression persists even for arbitrarily small growth and damping rates since epsilon(sub D) is nonzero in this limit, whereas delta(exp 2)F remains zero. The connection between the new exact energy expression and the at-best approximate epsilon(sub D) is described. The new expression motivates natural definitions of Hamiltonian action variables and signature. A general linear integral transform is introduced that maps the linear version of the noncanonical Hamiltonian structure, which describes the Vlasov equation, to action-angle (diagonal) form. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N92-33305# Advanced Aviation Concepts, Jupiter, FL.
WORKSHOP ON AERONAUTICAL DECISION MAKING (ADM). VOLUME 1: EXECUTIVE SUMMARY Final Report
Richard J. Adams, Catherine A. Adams, and Ronald John Lofaro Aug. 1992 76 p
(Contract DTFA01-90-C-00042)
(DOT/FAA/RD-92/14-Vol-1) Avail: CASI HC A05/MF A01

Presented here are the Aeronautical Decision Making (ADM) training accomplishments, limitations, and future needs from the perspectives of commercial operators, general aviation, military aviation and research development. A select group of experts on ADM was convened to share ideas, identify and explore future directions for advanced training. Cognitive training requirements based upon decision making task demands of both airplane and helicopter pilots and crews are analyzed. A major question which requires definitional research is: What is a real aircrew/pilot decision? (that is, when does an event generate a true decisional opportunity for a pilot or crew versus a 'one-path only' reaction, where the actual emphasis is not on cognitive decision making, but the application of procedures and basic airmanship). Going one step further, the group analyzed the decision making differences between expert and novice pilots when a real decision was required. Author

N92-33686# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Stabsbereich Oeffentlichkeitsarbeit.
MBB DEUTSCHE AEROSPACE FINANCIAL YEAR Annual Report, 1990 [MBB DEUTSCHE AEROSPACE: DAS GESCHAEFTSJAHR 1990]
May 1991 42 p In GERMAN
(ETN-92-91908) Avail: CASI HC A03/MF A01

Subjects covered were: economic situation, business progress, employment, research and development, investments, and results. The various fields of activity in helicopters, rail vehicles, aircraft, aerospace, military equipment, energy, new technologies, are described. During the financial year 1990, MBB was incorporated in the German Aerospace company DASA, whose majority participation in MBB was raised to 70 percent. ESA

N92-33808# Technische Univ., Berlin (Germany, F.R.). Fachbereich Informatik.
STRATEGY ORIENTED REQUIREMENT DETERMINATION: AN EVALUATION MODEL FOR PLANNED EVOLUTIONARY DEVELOPMENT OF STRATEGIC APPLICATION SYSTEMS Ph.D. Thesis [STRATEGIEORIENTIERTE ANFORDERUNGSERMITTLUNG: EIN VORGEHENSMODELL ZUR GERPLANT-EVOLUTIONAEREN ENTWICKLUNG STRATEGISCHER ANWENDUNGSSYSTEME]
Michael Lorenz 1991 224 p In GERMAN
(ETN-92-92138) Avail: CASI HC A10/MF A03

The development of an evaluation model, for software related requirement determination under strategic perspective, and its evaluation are considered in the framework of practical utilization. The evaluation model, including its related methods is examined in a concrete project situation, with regard to its capability in practical use. Besides the steps of methodical utilization, experiences and limits of the strategic formulation are summarized. ESA

N92-34041# Department of Energy, Washington, DC.
GUIDE TO GOOD PRACTICES FOR TRAINING OF TECHNICAL STAFF AND MANAGERS
Jul. 1992 36 p
(DE92-017686; DOE-STD-1008-92) Avail: CASI HC A03/MF A01

The purpose of the Department of Energy (DOE) Guide to Good Practices for Training of Technical Staff and Managers is to provide DOE contractor organizations with information that can

be used to modify existing programs or to develop new programs. DOE contractors should not feel obligated to adopt all parts of this guide. Rather, they can use the information in this guide to develop programs that apply to their facility. This guide can be used as an aid in the design and development of a facility's technical staff and managers' training program. This guide can be used in developing a program for initial and continuing training.
DOE

N92-34042# Department of Energy, Washington, DC.
GUIDE TO GOOD PRACTICES: EVALUATION INSTRUMENT EXAMPLES
Jul. 1992 64 p
(DE92-017688; DOE-STD-1006-92) Avail: CASI HC A04/MF A01

The purpose of the guide is to provide DOE contractor organizations with information that can be used to modify existing programs or to develop new programs. DOE contractors should not feel obligated to adopt all parts of this guide. Rather, they can use the information in this guide to develop programs that apply to their facility. This guide can be used as an aid in developing evaluation instruments. Examples of various methods and techniques have been included. These instruments are not intended to be used 'as is', but they provide guidance for training evaluation instrument development. The reference at the end of this guide offers additional information on the development and use of program evaluation instruments and discusses the analysis of evaluation results.
DOE

N92-34051# Westinghouse Hanford Co., Richland, WA.
STARTING AND MANAGING MULTIPLE WORKING GROUPS
J. L. Butcher Feb. 1992 7 p Presented at the 3rd Interagency OPSEC Support Staff Conference, Las Vegas, NV, 4-7 May 1992
(Contract DE-AC06-87RL-10930)
(DE92-014959; WHC-SA-1506; CONF-9205188-1) Avail: CASI HC A02/MF A01

This article was written to assist an Operations Security (OPSEC) Program Manager, who is anticipating expanding the local OPSEC program to more than one working group. This article provides insight on the management of multiple working groups and the challenges faced during expansion. Anticipating the challenges and initiating possible solutions at the beginning hopefully will lead to a smoother transition than the 'trial and error' or 'school of hard knocks' methods. This article is based on the experience gained from using both of those methods over a period of four years of managing up to seven working groups covering a wide variety of operations/activities and going through a major change in the Hanford Site mission.
DOE

N92-34052# Westinghouse Hanford Co., Richland, WA.
ORGANIZING MULTIPLE WORKING GROUPS
J. L. Butcher Feb. 1992 10 p Presented at the 3rd Interagency OPSEC Support Staff Conference, Las Vegas, NV, 4-7 May 1992
(Contract DE-AC06-87RL-10930)
(DE92-014962; WHC-SA-1507; CONF-9205188-2) Avail: CASI HC A02/MF A01

Multiple working groups are a way to expand an Operations Security (OPSEC) program with very little effort and expense to the organization. A program will realize considerable gain by using the efforts of many, and through increased networking, the OPSEC word will spread throughout a facility and organization. Multiple groups also provide insight as to the 'what' and 'where' of planning. Their knowledge of new activities is very important in ensuring that critical and sensitive items and indicators are developed and used at the onset. In addition, a broad variety of talents will become a part of the program. There can be several types of OPSEC working groups. In this article, two types of groups will be discussed. Both groups will be operating at the grassroots level to implement the OPSEC program. One group will be performing assessments or completing specific OPSEC goals in their area of responsibility. The second type of group will be an awareness group, which will be used in organizations with little, if any, OPSEC threat. To provide further understanding, the chairperson of both groups will jointly meet the OPSEC program Manager at regular intervals to establish operating policy, discuss broad problems, receive guidance and direction, and share information as to the OPSEC activities of all the groups. A sufficient number of working groups may vary from one to several. To determine what is sufficient, analyze the site or organization and consider the following factors: (1) mission, (2) type of facility, (3) total number of employees, (4) geographic separation, (5) organizational elements, and (6) cost. Each of these factors, are addressed with items to consider under each factor. Each will then be used in analyzing a very complex example.
DOE

N92-33466# Vrije Univ., Brussels (Belgium).
THE USOCS, THE RESOURCES MANAGEMENT, AND THEIR LINKS WITH TELESCIENCE
M. C. Limbourg *In* ESA, Telescience for Space Experimentation in the Fields of Space Science, Life, Materials and Fluid Sciences and Earth and Environmental Sciences Mar. 1992 p 59-66
(For primary document see N92-33457 24-12)
Copyright Avail: CASI HC A02/MF A02; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N92-33273# National Archives and Records Service, Washington, DC.
NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA) EVALUATION: RECORDS MANAGEMENT IN THE ENVIRONMENTAL PROTECTION AGENCY
Feb. 1992 86 p
(PB92-199132) Avail: CASI HC A05/MF A01

The National Archives and Records Administration (NARA) evaluation of the Environmental Protection Agency (EPA) focused on the overall management of EPA's records program, creation and maintenance of records, and records disposition. Special attention was given to maintenance and disposition in special categories including Superfund, contractor, and electronic records. NARA's evaluation revealed that proper records management practices are implemented very inconsistently within EPA despite agency directives and procedures that are generally satisfactory. Many offices adequately document their activities and handle their records in accordance with relevant federal or agency regulations. Conversely, a number of offices have no prescribed records creation, maintenance, or disposition procedures in place. These offices typically handle their records management responsibilities on an ad hoc basis.
Author

N92-33281# Naval Oceanographic and Atmospheric Research Lab., Monterey, CA.
QUALITY CONTROL FOR THE OPERATIONAL ATMOSPHERIC DATA BASE Final Report
Nancy L. Baker Feb. 1992 38 p
(AD-A253054; NOARL-25) Avail: CASI HC A03/MF A01

A new operational meteorological database has been developed to provide quality-controlled observations for the atmospheric analysis and prediction systems at Fleet Numerical Oceanography Center. Quality control is a vital and necessary first step in atmospheric analysis and prediction, since erroneous observations can adversely impact the accuracy of these environmental products. The objective quality control procedures for the data base were developed by the Atmospheric Directorate of the Naval Oceanographic and Atmospheric Research Laboratory and are described in NOARL Report 26. This report focuses on the specific details pertaining to the local implementation of the quality control system. These include the treatment of multiple, nonidentical

reports from the same station; errors introduced by data processing; bias corrections of radiosonde heights; and the subjective quality control of marine observations. This report provides the necessary information, such as the data base structure and data formats, required to use the operational atmospheric data base. GRA

N92-33287# Search Technology, Inc., Norcross, GA.
BIG GRAPHICS AND LITTLE SCREENS: MODEL-BASED DESIGN OF LARGE SCALE INFORMATION DISPLAYS Final Report, 1 Jan. 1989 - 30 Jun. 1992
Paul R. Frey, William B. Rouse, and Rosemary D. Garris Jun. 1992 105 p
(Contract N00014-89-C-0047)
(AD-A253071; STI-TR-8817-006) Avail: CASI HC A06/MF A02

The design of large scale information displays is addressed. Problems with traditional approaches to display design are discussed. It is argued that the evolving nature of human roles in complex systems will exacerbate these problems. A model-based framework for display design is proposed involving system models, task models, and human models of systems and tasks. This framework provides a basis for exploring three types of display design problems, including problems of evolution, deviation, and change. Use of the overall conceptual framework is illustrated in the context of an application involving design of computer-based graphical displays for a maintenance information system. Traditional maintenance information includes large graphical drawings that are difficult to portray on the small screens of computer-based maintenance information systems. This research investigates the design of graphical displays using display abstraction and aggregation as design parameters. A display's aggregation level reflects the field of view of a display, such as component, assembly, or system level diagrams. A display's abstraction level reflects the representation contained in a diagram, such as a component's form, function, or purpose in an assembly. The results from five experiments with experienced maintenance personnel are presented and design guidelines are suggested. GRA

N92-33299*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
NASA/DOD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT. REPORT 13: SOURCE SELECTION AND INFORMATION USE BY US AEROSPACE ENGINEERS AND SCIENTISTS: RESULTS OF A TELEPHONE SURVEY
Thomas E. Pinelli and Nanci A. Glassman (Continental Research, Norfolk, VA.) Sep. 1992 26 p
(RTOP 505-90-00)
(NASA-TM-107658; NAS 1.15:107658) Avail: CASI HC A03/MF A01

A telephone survey of U.S. aerospace engineers and scientists belonging to the Society of Automotive Engineers (SAE) was conducted between December 4, 1991 and January 5, 1992. The survey was undertaken to (1) validate the telephone survey as an appropriate technique for collecting data from U.S. aerospace engineers and scientists; (2) collect information about how the results of NASA/DoD aerospace research are used in the R&D process; (3) identify those selection criteria which affect the use of federally-funded aerospace R&D; and (4) obtain information that could be used to develop a self-administered mail questionnaire for use with the same population. The average rating of importance of U.S. government technical reports was 2.5 (on a 4-point scale); The mean/median number of times U.S. government technical reports were used per 6 months was 8/2. Factors scoring highest for U.S. government technical reports were technical accuracy (2.9), reliable data and technical information (2.8), and contains comprehensive data and information (2.7) on a 4-point system. The factors scoring highest for influencing the use of U.S. government technical reports were relevance (3.1), technical accuracy (3.06), and reliable data/information (3.02). Ease of use, familiarity, technical accuracy, and relevance correlated with use of U.S. government technical reports. Survey demographics, survey questionnaire, and the NASA/DoD Aerospace Knowledge Diffusion Research Project publications list are included. Author

N92-33428# Westinghouse Hanford Co., Richland, WA.
TRAINING REQUIREMENTS AND INFORMATION MANAGEMENT SYSTEM
T. F. Cillan and M. A. Hodgson May 1992 84 p
(Contract DE-AC06-87RL-10930)
(DE92-015819; WHC-EP-0447) Avail: CASI HC A05/MF A01

This is the software user's guide for the Training Requirements and Information Management System. This guide defines and describes the software operating procedures as they apply to the end user of the software program. This guide is intended as a reference tool for the user who already has an indepth knowledge of the Training Requirements and Information Management System functions and data reporting requirement. DOE

N92-33503# Naval Postgraduate School, Monterey, CA.
APPLICATION OF OPTICAL DISC DATABASES AND RELATED TECHNOLOGY TO PUBLIC ACCESS SETTINGS M.S. Thesis
David F. DeFord Mar. 1992 224 p
(AD-A252916) Avail: CASI HC A10/MF A03

Recently developed optical disc technology offers economical, convenient, and durable storage of large quantities of data. Advanced data retrieval software allows rapid search optical discs. A number of commercial and government publishers produce optical disc databases offering enhanced direct access to data, text or large reference indexes. In library settings direct patron access to optical disc databases has proven popular. This paper examines issues a librarian or information manager should consider before and during implementation of public access optical disc databases. It documents results of a trial optical disc implementation at the Naval Postgraduate School's Dudley Knox Library and a product survey identifying candidate optical disc database products library use. Computer hardware options for distribution of information from optical discs are discussed. A strategy is presented for further implementation of optical disc databases in the Dudley Knox Library. GRA

N92-33532# Air Force Inst. of Tech., Wright-Patterson AFB, OH.
THE ROLE OF PROTOTYPING IN GIS DESIGN: A CASE STUDY OF THE DIGITAL CHART OF THE WORLD M.S. Thesis
James M. Glesken 7 Mar. 1992 71 p
(AD-A252519; AFIT/CI/CIA-92-024) Avail: CASI HC A04/MF A01

The development and use of Geographic Information Systems (GIS) is growing rapidly as computers become more affordable and ever more powerful. Geographic Information System developers and users alike are faced with a complex array of problems during system design including definition of requirements, development of specifications, selection of hardware, and implementation of the system. Some have made poor decisions regarding these subjects in the past, often due to inadequate input into the planning process. Fortunately, recent years have seen increasing efforts on the part of developers, designers, and users to utilize structured GIS design methods to better control, define, and model critical features of new systems. The purpose of this study is to examine the role of prototyping, a software engineering concept, in the GIS design process. This study will first summarize the evolution of GIS design methodology to illustrate both its current status and how new ideas have been incorporated into the field. Then a case study will be used to evaluate the role that prototyping played in one GIS database development project and finally recommendations will be made for the further use of prototyping in GIS design. GRA

N92-33561# Naval Postgraduate School, Monterey, CA.
THE DESIGN AND IMPLEMENTATION OF A FUNCTIONAL INTERFACE FOR THE ATTRIBUTE-BASED MULTI-LINGUAL DATABASE SYSTEM M.S. Thesis
Sybil B. Mack Mar. 1992 100 p
(AD-A252935) Avail: CASI HC A05/MF A02

Traditionally, the design and implementation of a conventional database system begins with the selection of a data model, followed

by the specification of a model-based data language. Hence, the database system is restricted to a single data model and a specific data language. One alternative to this traditional approach to database-system development is the multi-lingual database system (MLDS). This alternative approach affords the user the ability to access and manage a large collection of databases, via several data models and their corresponding data languages, without the aforementioned limitations. This thesis presents a methodology for supporting the Functional Data Model and the Data Language DAPLEX for the MLDS. Specifically, we design an interface which translates DAPLEX data language calls into attribute-based data language (ABDL) requests. A description of the software engineering aspects of the implementation and an overview of the modules which comprise our DAPLEX language interface are provided. GRA

N92-33674# George Mason Univ., Fairfax, VA. Dept. of Information and Software Systems Engineering.
AN ALGORITHM FOR DYNAMIC DATA DISTRIBUTION PRELIMINARY VERSION
Ouri Wolfson and Sushil Jajodia Jul. 1992 5 p
(Contract N00014-90-J-1601)
(AD-A252875) Avail: CASI HC A01/MF A01

The replication scheme of a distributed database determines how many replicas of each object are created, and to which processors these replicas are allocated. This scheme critically affects the performance of a distributed system, since reading an object locally is less costly than reading it from a remote processor. Therefore in a read-intensive network a widely distributed replication is mandated. On the other hand, an update of an object is usually written to all, or a majority of the replicas, and therefore in a write-intensive network a narrowly distributed replication is mandated. In other words, the optimal replication scheme depends on the read-write pattern for each object. Currently, the replication scheme is established in a static fashion, when the distributed-database is designed, and it remains fixed until the designer manually intervenes to change the number of replicas or their location. If the read-write patterns are fixed and are known a priori, this is a reasonable solution. However, if the read-write patterns change dynamically, in unpredictable ways, a static replication scheme may lead to severe performance problems. In this paper we propose a practical algorithm, called Dynamic-Data-Allocation (DDA), that changes the replication scheme of an object (i.e. the processors which store a replica of the object) dynamically as the read-write pattern of the object changes in the network. We assume that the changes in the read-write pattern are not known a priori. GRA

N92-33890# Los Alamos National Lab., NM.
INTERPRETING SCIENCE IN INFORMAL SETTINGS: OPPORTUNITIES AND CHALLENGES FOR TECHNICAL COMMUNICATORS
J. Machen 1992 9 p Presented at the IEEE International Professional Communications Conference: Crossing Frontiers, Santa Fe, NM, 30 Sep. 1992
(Contract W-7405-eng-36)
(DE92-017449; LA-UR-92-1999; CONF-9209142-2) Avail: CASI HC A02/MF A01

The increasing trend toward interpreting science in informal settings offers new opportunities for explaining science and new opportunities for technical communicators in terms of career and service, but this trend also demands that communicators wear new hats, learn new skills, relinquish conventional ideas about how information should be presented, become more involved with their audiences, and place increased emphasis on testing the effectiveness of their work. DOE

N92-33931# Naval Postgraduate School, Monterey, CA.
A CASE STUDY OF INFORMATION RESOURCE MANAGEMENT IN THE DEPARTMENT OF DEFENSE M.S. Thesis
Joseph E. Harkleroad Mar. 1992 89 p
(AD-A253020) Avail: CASI HC A05/MF A01

This thesis develops a case study of a Department of Defense (DOD) activity that is suitable for presentation to military information resource management (IRM) students. The case will focus on the applicability of the Corporate Information Management (CIM) model as the framework for an IRM strategy for the Pacific Missile Range Facility (PMRF), Barking Sands, Hawaii. Presenting a case of organizational control and technical planning to future military managers will provide experience in analyzing problems that are unique to IRM in DOD. Use of this case study will also allow students to acquire skills, in developing action plans for a military organization. GRA

N92-33949*# ARC Professional Service Group, Inc., Landover, MD.
ONSITE ANALYSIS OF DATA FROM THE DYNAMICS EXPLORER (DE) SPACECRAFT Annual Report, 1 Feb. 1991 - 31 Jan. 1992
Shing F. Fung, Robert M. Candey, and Josephine N. Humphreys 28 Feb. 1992 34 p
(Contract NAS5-31207)
(NASA-CR-189271; NAS 1.26:189271) Avail: CASI HC A03/MF A01

The tasks performed by ARC Professional Services Group, Inc. fell into five parts: (1) dynamics explorer (DE) data analysis and modeling; (2) DE project support; (3) chemical release observations support; (4) VLF emissions and plasma instability studies; and (5) modeling of planetary radio emissions. Some recommendations for future considerations are also addressed. Author

N92-34092# California Univ., Berkeley. Lawrence Berkeley Lab.
A RELATION MERGING TECHNIQUE FOR RELATIONAL DATABASES
V. M. Markowitz Feb. 1992 10 p Presented at the 8th International Conference on Data Engineering, Phoenix, AZ, 3-7 Feb. 1992
(Contract DE-AC03-76SF-00098)
(DE92-017120; LBL-27842; CONF-920226-1) Avail: CASI HC A02/MF A01

Relation merging is employed in relational databases in order to reduce the need for joining relations. Merging, however, can create unnormalized relations. In this paper we propose a merging technique that preserves the high (Boyce-Codd) normal form of relational schemas consisting of relation-schemes, key dependencies, referential integrity constraints, and null constraints. The additional constraints generated by this merging technique can be effectively maintained using the mechanisms provided by several relational database management systems. DOE

N92-34140*# Research Inst. for Computing and Information Systems, Houston, TX.
EXPLORATORY STUDY ON PERFORMANCE MEASURES AS INDICATORS OF IS EFFECTIVENESS Interim Report
Peter C. Bishop (Houston Univ., Clear Lake, TX.) and Cissy Yoes (Houston Univ., Clear Lake, TX.) Apr. 1992 37 p
(Contract NCC9-16; RICIS Proj. IR-01a)
(NASA-CR-190642; NAS 1.26:190642) Avail: CASI HC A03/MF A01

The Information Systems Directorate at JSC/NASA has undertaken the reevaluation of its performance measures process and measures. Under the direction of a quality approach it is essential to identify an external perspective of how well an organization is performing. This study was conducted with two major objectives: (1) survey and summarize the academic literature on performance measures as indicators of information systems (IS) effectiveness; and (2) survey organizations for their experience in measuring for IS effectiveness. Four approaches to measuring the effectiveness of IS performance were identified: (1) listen to the customer for the things they need; (2) align with corporate goals; (3) benchmark against well-respected organizations; and (4) ask yourself what critical factors lead to success. The list of known methods for soliciting customer feedback are as follows: (1) executive visit; (2) survey, interview, and focus group; (3)

complaints and compliments; and (4) service level agreements. A common set of characteristics that satisfy customers was identified from the literature. The list includes elements such as the following: accuracy, timeliness, relevance, understandability, reliability, and completeness. Future research in this topic area should prove beneficial to determine the metrics for external validity. Author

N92-34155# Pattern Analysis and Recognition Corp., New Hartford, NY.
CATSS DATABASE DEVELOPMENT (CATSS DB) Final Report
Audrey A. Copperwheat, David Smith, Penelope S. Smith, and M. L. Taylor May 1992 39 p
(Contract F30602-87-C-0223)
(AD-A253390; RL-TR-92-83) Avail: CASI HC A03/MF A01

This report documents the technical results of the Cartographic Applications for Tactical and Strategic Systems Database (CATSS DB) effort. The CATSS DB effort was a key milestone in supporting the evaluation and delineation of the Air Force requirements for digital spatial data. This document describes the content, structure, schema, and attribution required to support known Air Force's requirements. The result of this effort is a database which was implemented within the intelligence cartographic facility at Rome Laboratory. This capability supports the loading and creation of data structures/formats required to support known operational requirements. In addition, it provides the technical base to define and validate new spatial data requirements, establish standards for data contents/structures, and the development of algorithms and applications software for functional demonstration. GRA

N92-34186# TRADOC Test and Experimentation Command, Fort Monroe, VA.
FUNCTIONAL REQUIREMENTS FOR ARMY LIBRARY AUTOMATION Final Report
Edwin B. Burgess, Patricia Alderman, Myra Craig, Wendy Hill, and Alta Linthicum 16 Jun. 1992 111 p
(AD-A253531) Avail: CASI HC A06/MF A01

The project to define the functional requirements of library systems in the Army was originally initiated to assist in the definition of the Library Installation Support Module, a portion of the Sustaining Base Information System (SBIS). As completed, it defines a base for Army-wide automation of libraries and provides a source document for libraries automating in the future. Librarians can use portions of the functional requirements to compile RFPs, and SOWs for local library automation projects. No system covers all the needs of all types of libraries, but many elements are common. For instance, almost all libraries maintain a database of their own book (or other media) holdings. Almost all libraries feel the need to lend their holdings and retrieve them, and keep track of their users. The authors assumed that any future system will be MARC (MAchine Readable Cataloging) based, but other citation, full-text, and image files are also proposed. Connectivity to other systems, including other Army, government, bibliographic utility, and commercial databases, are required. GRA

N92-34233*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
NASA/DOD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT. REPORT 14: ENGINEERING WORK AND INFORMATION USE IN AEROSPACE: RESULTS OF A TELEPHONE SURVEY
Thomas E. Pinelli, John M. Kennedy (Indiana Univ., Bloomington.), and Terry F. White (Indiana Univ., Bloomington.) Washington Oct. 1992 46 p
(RTOP 505-90-00)
(NASA-TM-107673; NAS 1.15:107673) Avail: CASI HC A03/MF A01

A telephone survey of U.S. aerospace engineers and scientists who were on the Society of Automotive Engineers (SAE) mailing list was conducted between August 14-26, 1991. The survey was undertaken to obtain information on the daily work activities of aerospace engineers and scientists, to measure various practices used by aerospace engineers and scientists to obtain STI, and to ask aerospace engineers and scientists about their use of electronic networks. Co-workers were found important sources of information. Co-workers are used to obtain technical information because the information they have is relevant, not because co-workers are accessible. As technical uncertainty increases, so does the need for information internal and external to the organization. Electronic networks enjoy widespread use within the aerospace community. These networks are accessible and they are used to contact people at remote sites. About 80 percent of the respondents used electronic mail, file transfer, and information or data retrieval to commercial or in-house data bases. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N92-33605# Executive Office of the President, Washington, DC.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT: FISCAL YEAR 1991 ACTIVITIES
1991 193 p
Avail: CASI HC A09/MF A03

The National Aeronautics and Space Act of 1958 directed that the annual Aeronautics and Space Report include a 'comprehensive description of the programmed activities and the accomplishments of all agencies of the United States in the field of aeronautics and space activities during the preceding calendar year'. This year's report (like last year's) was prepared on a fiscal year basis, which is consistent with the budget period now used in federal government programs. The budgets for aeronautics and space - distributed among 14 different Federal agencies - have promoted significant advances in the nation's scientific and technical knowledge that promise to improve the quality of life on Earth by increasing scientific understanding, expanding the economy, improving the environment, and defending freedom. Author

N92-33798# CSP Japan, Inc., Tokyo.
INTERNATIONAL COOPERATION AND JAPAN'S ROLE IN LUNAR AND PLANET EXPLOITATION [TSUKI, WAKUSEI KAIHATSU NI OKERU KOKUSAI KYOURYOKU TO NIHON NO YAKUWARI]
Tomoko Iguchi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 19 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

N92-33799# Shimizu Corp. (Japan). Space Project Office.
ESTABLISHMENT OF LEGISLATIVE SYSTEM FOR SPACE COMMERCIALIZATION [UCHUU SHOUGYOU KA NI OKERU HOU SEIDO NO SEIBI]
Kazuya Fushimi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 9 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N92-33265# Pacific Northwest Lab., Richland, WA.
TECHNOLOGY TRANSFER SURVEY REPORT
Dec. 1991 267 p
(DE92-015580; DOE/PE-01830T-H15) Avail: CASI HC A12/MF A03

An attempt was made to describe technology transfer activities throughout the US Department of Energy (DOE). The findings of case studies that were completed by DOE staff during the fall of 1989 and updated in 1991 are presented. The intent of the survey was to provide a starting point and direction for future DOE technology transfer activities. Because of the pioneering nature of this effort, the survey was encompassing in order to obtain as much information as possible, without imposing any assumptions. Therefore, statistical hypothesis testing of the results is neither valid nor appropriate. The reader will learn about the full extent of technology transfer activities and strategies used by DOE and the subjective degree of their success. It is hoped that this knowledge will help foster an even more rewarding relationship between DOE and participating organizations. DOE

88 SPACE SCIENCES (GENERAL)

N92-33478*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
ORBITAL DEBRIS: TECHNICAL ISSUES AND FUTURE DIRECTIONS
Andrew Potter, ed. Sep. 1992 316 p Proceedings held in Baltimore, MD, 16-19 Apr. 1990; sponsored by AIAA and DOD
(NASA-CP-10077; S-637; NAS 1.55:10077) Avail: CASI HC A14/MF A03

An international conference on orbital debris sponsored jointly by the American Institute of Aeronautics and Astronautics, NASA, and the Department of Defense, was held in Baltimore, Maryland, 16-19 Apr. 1990. Thirty-three papers were presented. The papers were grouped into the areas of measurements, modeling, and implications of orbital debris for space flight. New radar and optical measurements of orbital debris were presented that showed the existence of a large population of small debris. Modeling of potential future environments showed that runaway growth of the debris population from random collisions was a real possibility. New techniques for shielding against orbital debris and methods for removal of satellites from orbit were discussed. Author

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N92-33658*# Washington Univ., Seattle. Dept. of Astronomy.
SILICON ABUNDANCES IN POPULATION I GIANTS
Erika Boehm-Vitense 1992 16 p
(Grant NsG-5398)
(NASA-CR-190855; NAS 1.26:190855) Avail: CASI HC A03/MF A01

Silicon to carbon abundance ratios for population I giants were determined from emission lines originating in the transition layers between stellar chromospheres and coronae. For effective temperatures larger than 6200 K we find a group of stars with increased silicon to carbon but normal nitrogen to carbon abundance ratios. These stars are presumably descendents from Ap stars with increased surface silicon to carbon abundance ratios. For G stars this anomaly disappears as is to be expected due to the increased depth of the convection zone and therefore deeper mixing which dilutes the surface overabundances. The disappearance of the abundance anomalies proves that the anomalous abundances observed for the F giants are indeed only a surface phenomenon. It also proves that the same holds for their progenitors, the Ap and Am stars, as has been generally believed. Unexplained is the increased silicon to carbon abundance ratio observed for several stars cooler than 5100 L. RS CVn and related stars do not show this increased abundance ratio. There are also some giants which appear to be enriched in carbon, perhaps due to a helium flash with some mixing if the star is a clump star. Author

N92-33745*# Old Dominion Univ., Norfolk, VA. Dept. of Physics.
THE SIMULATED SPACE PROTON ENVIRONMENT FOR RADIATION EFFECTS ON SPACE TELESCOPE IMAGING SPECTROGRAPH (STIS) Annual Progress Report, 16 Apr. 1991 - 15 Apr. 1992
Jacob Becher and Walter Fowler Aug. 1992 45 p
(Grant NAG5-1527)
(NASA-CR-190618; NAS 1.26:190618) Avail: CASI HC A03/MF A01

The space telescope imaging spectrograph (STIS) is a second generation instrument planned for the Hubble Space Telescope (HST) which is currently in orbit. Candidate glasses and other transmitting materials are being considered for order sorters, in-flight calibration filters, detector windows, and calibration lamps. The glasses for in-flight calibration filters showed significant drop in UV transmission, but can probably still be used on STIS. The addressed topics include the Hubble radiation environment, simulation of orbital exposure at Harvard Cyclotron Laboratory, measurement of spectral transmission, and comments on individual samples. I.I.C.

N92-34025 Cornell Univ., Ithaca, NY.
PHOTOMETRY OF ICY SATELLITE SURFACES Ph.D. Thesis
Anne Jacqueline Verbiscer 1991 199 p
Avail: Univ. Microfilms Order No. DA9204081

Detailed photometric analyses of icy satellite surfaces are used to determine physical regolith properties indicative of exogenic and endogenic geologic processes. The Hapke (1986) photometric equation relates the average single scattering albedo, regolith compaction, mean topographic slope angle, and average directional scattering behavior of a particulate surface to the reflectance observed at specific viewing geometries. The Hapke equation was applied to Voyager imaging data from the saturnian satellites Rhea, Mimas, and Enceladus as well as to in situ goniometric measurements of terrestrial snows and frosts. Disk-integrated and disk-resolved photometric properties of these satellites are determined from solutions to the Hapke equation in terms of the single scattering albedo, the macroscopic surface roughness, the single particle phase function, the amplitude of the opposition surge, and the regolith compaction parameter. Accurate albedo maps of each icy satellite reveal that Rhea exhibits the largest hemispherical albedo dichotomy with its leading hemisphere 0.26 sup m brighter than its trailing hemisphere, while both Mimas and Enceladus have brighter trailing hemispheres by about 0.1 sup m. Mimas has the largest photometric roughness of any outer Solar System satellite analyzed in this manner, while the smooth and ridged plains of Enceladus are among the least photometrically rough. All icy satellites of the outer Solar System are remarkably backscattering, in striking contrast to their terrestrial counterparts which are moderately to strongly forward scattering. Models of areal and intimate mixtures demonstrate that the frost component of the surfaces of these outer satellites must itself be backscattering. The difference may arise because more complex internal textures of frost particles are able to be preserved under the low-temperature and low-gravity conditions of the outer satellites.

The Hapke equation is also modified to accommodate anisotropic multiple scattering, and important correction for satellites with very high single scattering albedos such as Enceladus. Dissert. Abstr.

N92-34060*# Washington Univ., Seattle. Dept. of Astronomy.
EMISSION LINES IN THE LONG PERIOD CEPHEID L CARINAE
Erika Boehm-Vitense and Stanley G. Love 1991 48 p
(Grant NsG-5398)
(NASA-CR-190853; NAS 1.26:190853) Avail: CASI HC A03/MF A01

For the Cepheid (l) Carinae with a pulsation period of 35.5 days we have studied the emission line fluxes as a function of pulsational phase in order to find out whether we see chromosphere and transition layer emission or whether we see emission due to an outward moving shock. All emission lines show a steep increase in flux shortly before maximum light suggestive of a shock moving through the surface layers. The large ratio of the C IV to C II line fluxes shows that these are not transition layer lines. During maximum light the large ratio of the C IV to C II line fluxes also suggests that we see emission from a shock with velocities greater than 100 km/sec such that C IV emission can be excited. With such velocities mass outflow appears possible. The variations seen in the Mg II line profiles show that there is an internal absorption over a broad velocity band independent of the pulsational phase. We attribute this absorption to a circumstellar 'shell'. This 'shell' appears to be seen also as spatially extended emission in the O I line at 1300 angstrom, which is probably excited by resonance with Ly beta. Author

N92-34195*# American Astronomical Society, Washington, DC.
THE 30TH AAS GODDARD MEMORIAL SYMPOSIUM. WORLD SPACE PROGRAMS AND FISCAL REALITY: SYNOPSIS
1992 33 p Presented in Alexandria, VA, 9-10 Apr. 1992
(NASA-TM-107971; NAS 1.15:107971) Avail: CASI HC A03/MF A01

A full proceedings of the symposium will be issued later in the year. This synopsis consists of summations of three sessions by appointed rapporteurs. International figures in space and in politics spoke at the sessions. Themes of international cooperation and fiscal reality pervaded the conference. International speakers from Canada, the European Space Agency, Russia, Japan and China and other countries addressed the topic of the symposium. American representation included Senator Barbara Mikulski, former NASA administrator James Beggs and other speakers. R.L.B.

N92-34230*# Washington Univ., Seattle. Dept. of Astronomy.
ABSORPTION LINE PROFILES IN A COMPANION SPECTRUM OF A MASS LOSING COOL SUPERGIANT
Liliya L. Rodrigues and Erika Boehm-Vitense 1990 45 p
(Grant NsG-5398)
(NASA-CR-190854; NAS 1.26:190854) Avail: CASI HC A03/MF A01

Cool star winds can best be observed in resonance absorption lines seen in the spectrum of a hot companion, due to the wind passing in front of the blue star. We calculated absorption line profiles that would be seen in the ultraviolet part of the blue companion spectrum. Line profiles are derived for different radial dependences of the cool star wind and for different orbital phases of the binary. Bowen and Wilson find theoretically that stellar pulsations drive mass loss. We therefore apply our calculations to the Cepheid binary S Muscae which has a B5V companion. We find an upper limit for the Cepheid mass loss of M less than or equal to 7 x 10(exp -10) solar mass per year provided that the stellar wind of the companion does not influence the Cepheid wind at large distances. Author

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N92-33410# Amptek, Inc., Bedford, MA.
FEASIBILITY STUDY FOR A COMPACT ENVIRONMENTAL ANOMALY SENSOR (CEASE)
Alan C. Huber, John O. McGarity, John A. Pantazis, Hugh Anderson (Science Applications International Corp., Bellevue, WA.), and Douglas Potter (Science Applications International Corp., Bellevue, WA.) 14 Oct. 1991 20 p
(Contract F19628-90-C-0159)
(AD-A252843; PL-TR-92-2047; AD-E201050; SR-1) Avail: CASI HC A03/MF A01

The local environmental conditions that a spacecraft operates within may induce occasional anomalous behavior that can impact reliability and performance. The Compact Environmental Anomaly Sensor (CEASE) is an instrument being developed to detect local environmental perturbations and provide the host spacecraft with various anomaly alerts along with confidence factors that allow the host spacecraft to conduct its operations in a manner to minimize these anomalous responses or to flag data as suspect due to local conditions. This report covers the first year of a feasibility study of this instrument. GRA

N92-33688# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik.
THE SPATIAL DISTRIBUTION OF FAR INFRARED LINE RADIATION IN EXTERNAL GALAXIES AS MEASURED WITH AN IMAGE FORMING FABRY-PEROT SPECTROMETER Thesis - Ludwig-Maximilians-Univ. [DIE RAEUMLICHE VERTEILUNG VON FERNINFRAROTLINIENSTRAHLUNG IN EXTERNEN GALAXIEN GEMESSEN MIT EINEM ABBILDENDEN FABRY-PEROT-SPEKTROMETER]
Norbert Geis Dec. 1991 159 p In GERMAN
(MPE-231; ETN-92-91910) Copyright Avail: CASI HC A08/MF A02

A spectrometer for wavelengths between 40 and 200 micrometers is designed. Two and three cryogenic Fabry Perot interferometers were used for the spectral selection. The velocity resolution could be chosen in a range of 2 to 500 km/s. During the first flight series, the variation of the interactions of massive young stars with the interstellar medium, and the spectral mapping of a series of objects in our Galaxy are studied. The analysis of line intensities of the far infrared continuum showed that even in extreme fall of the starburst galaxy M82, the interstellar medium is not dominated by ultraviolet radiant density, but that the main part of the emission originates from photodissociation fields. ESA

N92-34220*# Smithsonian Astrophysical Observatory, Cambridge, MA.
INVESTIGATION OF NONLINEAR E.M. PHENOMENA IN THE TETHERED MAGNETOSPHERIC CLOUD Final Report, 1 Sep. 1989 - 31 Aug. 1990
Yakov L. Alpert Oct. 1990 42 p
(Contract NAS8-36809)
(NASA-CR-184360; NAS 1.26:184360) Avail: CASI HC A03/MF A01

Nonlinear effects of parametric and of heating type, produced in a plasma under the action of an electric field E(sub 0)(e exp i(omega)t), are considered in this work in connection with the Tethered Magnetospheric Cloud (TMC) accompanying the Tether Satellite System (TSS). The theoretical results show that these phenomena should appear in the ionosphere at high altitudes Z greater than or = (150-200) km, particularly, at Z approximately = 300 km of the TSS system orbit. Therefore, it is of a special interest to search these phenomena by such a unique experiment as the forthcoming first TSS-I and by the future, perhaps modified TSS missions. Because of the parametric decay instability, new branches of wave may be excited both around the electron and ion Lengmuir frequencies Omega (sub 0) = 2(pi)f(sub 0) and

Omega (sub 0) = 2(pi)f(sub 0) under the influence of high frequency (HF), (f less than or = 10(exp 6) to few 10(exp 6) Hz), strong electric waves. The heating of all the kinds of particles is growing up very quickly in the ionosphere with altitude in the extra low and very low frequency ranges, F approximately = (1 to 10(exp 4) Hz, discussed below. The temperatures (energies), for example, of the electrons accelerated by the electric field become larger than the ionization potential in this frequency range already at altitudes Z greater than or = (150 - 200) km when the amplitude of the electric field is the absolute value of E(sub 0) approximately = (1-2) mV/m. The sources of these electric fields may be in the TSS-I mission, that so called Phantom Loop (PL) - the Tethered Electrodynamic Tail (TET), and the different kind of electromagnetic oscillations produced by different kinds of instabilities in the TMC plasma. The growth rates of these instabilities will become very high in the TSS surrounding magnetoplasma. However, in the future TSS missions, special artificial sources (generators) of electric fields should be used for these investigations. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N92-33720*# Atmospheric and Environmental Research, Inc., Cambridge, MA.

REANALYSIS OF MARINER 9 UV SPECTROMETER DATA FOR OZONE, CLOUD, AND DUST ABUNDANCES, AND THEIR INTERACTION OVER CLIMATE TIMESCALES Annual Progress Report, 1 May 1991 - 1 Aug. 1992

Bernhard Lee Lindner 10 Aug. 1992 54 p
(Contract NASw-4614)
(NASA-CR-190657; NAS 1.15:190657) Avail: CASI HC A04/MF A01

Research activities to date are discussed. Selected Mariner 9 UV spectra were obtained. Radiative transfer models were updated and then exercised to simulate spectra. Simulated and observed spectra compare favorably. It is noted that large amounts of ozone are currently not retrieved with reflectance spectroscopy, raising large doubts about earlier published ozone abundances. As these published abundances have been used as a benchmark for all theoretical photochemical models of Mars, this deserves further exploration. Three manuscripts were published, and one is in review. Papers were presented and published at three conferences, and are planned for five more conferences in the next six months. The research plan for the next reporting period is discussed and involves continuing studies of reflectance spectroscopy, further examination of Mariner 9 data, and climate change studies of ozone. For individual titles, see N92-33721 through N92-33728.

N92-33721*# Atmospheric and Environmental Research, Inc., Cambridge, MA.

[OVERVIEW FOR THE REANALYSIS OF MARINER 9 UV SPECTROMETER DATA FOR OZONE, CLOUD, AND DUST ABUNDANCES, AND THEIR INTERACTION OVER CLIMATE TIMESCALES]

Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 21 p
(For primary document see N92-33720 24-91)
Avail: CASI HC A03/MF A01

Mariner 9 UV spectrometer data were reinverted for the ozone abundance, cloud abundance, dust abundance, and polar-cap albedo. The original reduction of the spectra ignored the presence of atmospheric dust and clouds, even though their abundance is substantial and can mask appreciable amounts of ozone if not accounted for (Lindner, 1988). The Mariner 9 ozone data has been used as a benchmark in all theoretical models of atmospheric composition, escape, and photochemistry. A second objective is to examine the data for the interrelationship of the ozone cycle, dust cycle, and cloud cycle, on an annual, inter-annual, and climatic basis, testing predictions by Lindner (1988). This also has implications for many terrestrial ozone studies, such as the ozone hole, acid rain, and ozone-smog. A third objective is to evaluate the efficacy of the reflectance spectroscopy technique at retrieving the ozone abundance on Mars. This would be useful for planning ozone observations on future Mars missions or the terrestrial troposphere. Author

N92-33722*# Atmospheric and Environmental Research, Inc., Cambridge, MA.

WHY IS THE NORTH POLAR CAP ON MARS DIFFERENT THAN THE SOUTH POLAR CAP?

Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 2 p
(For primary document see N92-33720 24-91)
Avail: CASI HC A01/MF A01

One of the most puzzling mysteries about the planet Mars is the hemispherical asymmetry in the polar caps. Every spring, the seasonal polar cap of CO2 recedes until the end of summer, when only a small part, the residual polar cap, remains. During the year that Viking observed Mars, the residual polar cap was composed of water ice in the Northern Hemisphere (Kieffer et al., Science, 194, 1341, 1976) but was primarily carbon dioxide ice in the Southern Hemisphere (Kieffer, J. Geophys. Res., 84, 8263, 1979). Scientists have sought to explain this asymmetry by modeling observations of the latitudinal recession of the polar cap and seasonal variations in atmospheric pressure (since the seasonal polar caps are primarily frozen atmosphere, they are directly related to changes in atmospheric mass). These models reproduce most aspects of the observed annual variation in atmospheric pressure fairly accurately. Furthermore, the predicted latitudinal recession of the northern polar cap in the spring agrees well with observations, including the fact that the CO2 ice is predicted to completely sublime away. However, these models all predict that the carbon dioxide ice will also sublime away during the summer in the Southern Hemisphere, unlike what is observed. This paper will show how the radiative effects of ozone, clouds, and airborne dust, light penetration into and through the polar cap, and the dependence of albedo on solar zenith angle affect CO2 ice formation and sublimation, and how they help explain the hemispherical asymmetry in the residual polar caps. These effects have not been studied with prior polar cap models.
Author

N92-33723*# Atmospheric and Environmental Research, Inc., Cambridge, MA.

MARS SEASONAL CO2 ICE LIFETIMES AND THE ANGULAR DEPENDENCE OF ALBEDO Abstract Only

Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 1 p
(For primary document see N92-33720 24-91)
Avail: CASI HC A01/MF A01

The albedo of the polar caps on Mars brightens appreciably at high solar zenith angle (Warren et al., J. Geophys. Res., 95, 14717, 1990), an effect not included in prior polar-cap energy-balance models. This decreases absorption of sunlight by the polar cap, hence decreasing sublimation of CO2 ice. Lindner (J. Geophys. Res., 95, 1367, 1990) has shown that the radiative effects of clouds and airborne dust will increase sublimation of CO2 ice over that predicted by prior polar-cap energy-balance models. Furthermore, observations hint that more clouds may exist in the Northern Hemisphere, which Lindner (1990) has shown would sublime CO2 ice more quickly in the north than in the south. I show here that the effects of the solar zenith angle dependence of albedo and the radiative effects of clouds and dust offset each other, but act to extend the lifetime of CO2 ice on the south pole more than on the north pole, possibly explaining the observed hemispherical asymmetry in the residual polar caps without the need of a hemispherical asymmetry in polar-cap albedo required by prior models. Another positive aspect of this solution is that

neither the inclusion of the solar zenith angle dependence of albedo nor the radiative effects of clouds and dust should appreciably change prior model agreement with observations of the annual cycle of surface pressure and the recession of the polar caps equatorward of 75 degrees latitude. Author

N92-33724*# Atmospheric and Environmental Research, Inc., Cambridge, MA.
SIMULATIONS OF THE SEASONAL POLAR CAPS ON MARS
Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 2 p
Previously announced as N92-29033 (For primary document see N92-33720 24-91)
Avail: CASI HC A01/MF A01

One of the most puzzling mysteries about the planet Mars is the hemispherical asymmetry in the polar caps. Every spring the seasonal polar cap of CO2 recedes until the end of summer, when only a small part, the residual polar cap, remains. During the year that Viking observed Mars, the residual polar cap was composed of water ice in the Northern Hemisphere (Kieffer et al., Science, 194, 1341, 1976), but was primarily carbon dioxide ice in the Southern Hemisphere (Kieffer, J. Geophys. Res., 84, 8263, 1979). Scientists have sought to explain this asymmetry by modeling observations of the latitudinal recession of the polar cap and seasonal variations in atmospheric pressure (since the seasonal polar caps are primarily frozen atmosphere, they are directly related to changes in atmospheric mass). These models reproduce most aspects of the observed annual variation in atmospheric pressure fairly accurately. Furthermore, the predicted latitudinal recession of the northern polar cap in the spring agrees well with observations, including the fact that CO2 ice is predicted to completely sublime away. However, these models all predict that the carbon dioxide ice will also sublime away during the summer in the Southern Hemisphere, unlike what is observed. It is shown here how the radiative effects of ozone, clouds, and airborne dust, light penetration into and through the polar cap, and the dependence of albedo on solar zenith angle affect CO2 ice formation and sublimation, and how they help explain the hemispherical asymmetry in the residual polar caps. These effects have not been studied with prior polar cap models. The combination of the effects of solar zenith angle on albedo and the radiative effects of clouds and dust act to extend the lifetime of CO2 ice on the south pole relatively more than on the north pole, possibly explaining the hemispherical asymmetry in the residual polar caps without the need of a hemispherical asymmetry in polar cap albedo. This does not imply that a hemispherical asymmetry in polar cap albedo does not exist, but that one is not necessary. Observations of the regression of the polar caps and the annual cycle in atmospheric pressure are reproduced fairly well by the model, as shown in the figures, although further improvement is needed. When CO2 ice is retained at the south pole, the model predictions of the annual cycle in atmospheric pressure have a phase shift relative to the data, no matter what model input parameters are used. We are investigating other processes not included in prior polar cap models. Author

N92-33725*# Atmospheric and Environmental Research, Inc., Cambridge, MA.
SUNLIGHT PENETRATION THROUGH THE MARTIAN POLAR CAPS: EFFECTS ON THE THERMAL AND FROST BUDGETS
Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 11 p
(For primary document see N92-33720 24-91)
(Contract NASw-4444)
Avail: CASI HC A03/MF A01

An energy balance model of the seasonal polar caps on Mars is modified to include penetration of solar radiation into and through the ice. Penetration of solar radiation has no effect on subsurface temperature or total frost sublimation if seasonal ice overlies a dust surface. An effect is noted for seasonal ice which overlies the residual polar caps. For the case of an exposed water-ice residual polar cap, the temperature at depth is calculated to be up to several degrees warmer and the calculated lifetime of seasonal CO2 frost is slightly lower when penetration of sunlight is properly treated in the model. For the case of a residual polar cap which is perennially covered by CO2 frost, the calculated lifetime of seasonal CO2 frost is very slightly increased as a result of sunlight penetration through the ice. Hence, penetration of sunlight into the ice helps to stabilize the observed dichotomy in the residual polar caps on Mars, although it is a small effect. Author

N92-33726*# Atmospheric and Environmental Research, Inc., Cambridge, MA.
DOES UV INSTRUMENTATION EFFECTIVELY MEASURE OZONE ABUNDANCE?
Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 6 p
(For primary document see N92-33720 24-91)
Avail: CASI HC A02/MF A01

Measurements of O3 on Mars provide significant information about the chemistry and composition of the atmosphere, including long-term changes. The most extensive and accurate data were inferred from the Mariner 9 UV spectrometer experiment. Mars O3 shows strong seasonal and latitudinal variation, with column abundances ranging from 0.2 microns at equatorial latitudes to 60 microns over the northern winter polar latitudes (1 micron-atm is a column abundance of 2.689 x 10(exp 15) molecules cm(exp-2)). The Mariner 9 UV spectrometer scanned from 2100 to 3500 Angstroms in one of its two spectral channels every 3 seconds with a spectral resolution of 15 Angstroms and an effective field-of-view of approximately 300 km(exp 2). Measurements were made for almost half a Martian year, with winter and spring in the Northern Hemisphere and summer and fall in the Southern Hemisphere. The detectability limit of the spectrometer was approximately 3 microns of ozone. The UV spectrometer on Mariner 9 was incapable of penetrating the dust during dust storms; the single-scattering albedo and phase function of airborne dust and cloud ice are not known to the degree required to extract the small UV signal reflected up from near the surface. The reflectance spectroscopy technique would also have difficulty detecting the total column abundance of O3 in cases where large dust abundances exist together with the polar hood, especially at high latitudes where large solar zenith angles magnify those optical depths; yet these cases would contain the maximum O3, based on theoretical results. It is quite possible that the maximum O3 column abundance observed by Mariner 9 of 60 microns is common. In fact, larger quantities may exist in some of the colder areas with optically thick clouds and dust. As the Viking period often had more atmospheric dust loading than did that of Mariner 9, the reflectance spectroscopy technique may even have been incapable of detecting the entire O3 column abundance during much of the Mars year that Viking observed, particularly at high latitudes. Author

N92-33727*# Atmospheric and Environmental Research, Inc., Cambridge, MA.
CO2 ICE ON MARS: THEORETICAL SIMULATIONS
Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 4 p
(For primary document see N92-33720 24-91)
Avail: CASI HC A01/MF A01

A theoretical model of the energy budget of the polar caps of Mars has been created which is used to study the hemispherical asymmetry in CO2 ice. The observations which show survival of seasonal CO2 ice in the Southern Hemisphere in summer and not in the Northern Hemisphere in summer have been reproduced. Author

N92-33728*# Atmospheric and Environmental Research, Inc., Cambridge, MA.
HOW WELL IS MARTIAN OZONE INFERRED WITH REFLECTANCE SPECTROSCOPY? Abstract Only
Bernhard Lee Lindner *In its* Reanalysis of Mariner 9 UV Spectrometer Data for Ozone, Cloud, and Dust Abundances, and Their Interaction Over Climate Timescales 10 Aug. 1992 1 p (For primary document see N92-33720 24-91)
Avail: CASI HC A01/MF A01

The Mariner 9 UV spectrometer scanned from 2100 to 3500 Angstroms in one of its two spectral channels every 3 seconds with a spectral resolution of 15 Angstroms and an effective field-of-view of approximately 300 km(exp 2). The only gaseous absorption in the 2000 to 3000 Angstrom region was assumed to come from the Hartley band system of ozone, and therefore the amount of ozone was inferred by fitting this absorption feature with laboratory data of ozone absorption. Mars O3 as inferred from these spectra shows strong seasonal and latitudinal variation, with column abundances ranging from 0.2 microns at equatorial latitudes to 60 microns over the northern winter polar latitudes. The detectability limit of the spectrometer was approximately 3 microns. I use a radiative transfer model based on the discrete ordinate method to calculate synthetic radiance spectra. When typical amounts of dust and cloud are present, significant underestimation of O3 occurs. A factor of 3 times as much O3 is needed to generate the same spectrum for cloudy, dusty atmospheres as for a clear atmosphere. If the scattering properties of Martian clouds and dust were well known, then their appearance would not be a problem, as a model would be capable of retrieving the O3 abundance. However, these properties are not well known, which raises doubts about the effectiveness of the current UV spectroscopy technique used to measure O3. Spatial and temporal variability in temperature and water vapor have been claimed to account for the scatter of the data points. However, water vapor is a small source of odd hydrogen in the winter polar atmosphere, and may not account for most of the variability. Masking by clouds and dust may also account for some of the observed O3 variability, because the nature and opacity of the clouds and dust in the polar hood change dramatically in latitude and even on a day-to-day basis. As the maximum O3 abundance resides near the surface, spacecraft must be able to observe through the entire cloud and dust abundance in order to actually see the total O3 column abundance. If reflectance spectroscopy is used, as on Mariner 9, then the cloud and the airborne dust must be traversed twice; first by the incoming solar flux down to the surface, and then once again upon reflection from the surface out to the spacecraft. Author

N92-33753# National Space Development Agency, Tokyo (Japan).
FUTURE SPACE ACTIVITIES WORKSHOP: LUNAR BASE WORKSHOP 1991 [SHOURAI NO UCHUU KATSUDOU WAKUSHOPPU: GETSUMENKICHI WAKUSHOPPU 1991]
17 Jul. 1991 844 p In JAPANESE Workshop held in Ibaraki, Japan, 17-19 Jul. 1991
(JTN-92-80387) Avail: CASI HC A99/MF A10

Proceedings from the conference are presented in veiwgraph form. The following topics were discussed: manned space activity, manned service platforms, life support system, space shower, Japanese space programs, Mars explorations, Mars observation satellites, atmospheric reentry, Mars landing and exploration missions, scientific exploration vehicles, sample return missions, International Asteroid Mission, lunar explorations, lunar soft landing, lunar module, lunar surface vehicles, manned lunar surface sites, lunar surface robots, lunar base construction, nuclear power plants, solar power generation, space transportation systems, fly-back boosters, international cooperation, miniaturizing artificial satellites, and space manufacturing. For individual titles, see N92-33754 through N92-33799.

N92-33754# National Space Development Agency, Ibaraki (Japan).
REVIEW ON MANNED SERVICE PLATFORM (MSPF) [YUUJIN SABISU PURATTOFOMU (MSPF) NO KENTOU] **c18**
Yutaka Takano *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The Manned Service Platform (MSPF) is described. The MSPF is, in reality, a small space station and will be constructed in orbit. There are three reasons to construct MSPF's: (1) to establish on-orbit service bases for other spacecraft; (2) to conduct technology development and verification of manned space activities that are particular to Japan; and (3) to provide manned space experiment opportunities in the area of space environment utilization. Author (NASDA)

N92-33755# Mitsubishi Electric Corp., Kamakura (Japan).
ELEMENT TECHNOLOGIES FOR MANNED SERVICE PLATFORMS [YUUJIN SABISU PURATTOFOMU NO YOUSO GIJUTSU] **c18**
Mitsuru Kojima, Hiroaki Obara, and Katsutoshi Oomura *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The space station, in low earth orbit (LEO), is preeminent in its ability to function as the nucleus of a space-based infrastructure. The space station program is being promoted as a development center, and Japan is participating in the program by developing the Japanese Experiment Module (JEM). Due to limitations inherent in the space station's design, it is necessary to develop Japan's original manned platform. Problems are to be expected in the development of basic technologies for the Manned Service Platform (MSPF). Four of these basic technologies are investigated. The areas are as follows: (1) structure and mechanism technology; (2) attitude and orbit control technology; (3) automation and autonomy technology; and (4) manned support technology.
Author (NASDA)

N92-33756# Hitachi Ltd., Tokyo (Japan).
CONCEPTUAL DESIGN FOR MANNED SERVICE PLATFORMS [YUUJIN SABISU PURATTOFOMU NO GAINEN SEKKEI] **c18**
Shouichi Hoshina, Ryuusuke Abe, and Shigeru Kimura *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 23 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Conceptual designs of past manned service platforms (MSPF's) are summarized. Mission concepts and system architectures are evaluated by comparing them to reference examples. The largest design drivers are the infrastructure concepts and development of the integrated assembly sequences. First, the functions and properties to satisfy the users' requirements are reviewed in general, and then the characteristics of the MSPF (Manned Service Platform) project are analyzed. Reviews are conducted on their system concepts, assembly and construction, and their operations. Author (NASDA)

N92-33757# Kawasaki Heavy Industries Ltd., Kobe (Japan).
REVIEW ON LIFE SUPPORT TECHNOLOGIES IN EXTRA-VEHICULAR ACTIVITY TECHNOLOGY [SENGAI KATSUDOU GIJUTSU NI OKERU SEIMEI IJI GIJUTSU NO KENTOU] **c54**
Hiroyuki Torii *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Reviews are conducted of life support systems in space suits for Extra-Vehicular Activity (EVA). The reviews are also conducted for non-decompression type space suits. In non-decompression type suits, the interior pressure is increased and this allows the omission of prebreathing. Reviews are presented for the more

fundamental technology of space suits. Technical problems concerning the development of non-decompression type space suits are also reviewed. Topics discussed include the following: carbon dioxide absorbents, the interior pressure of space suits, and oxygen partial pressure meters. Author (NASDA)

N92-33758# Takenaka Works, Osaka (Japan).
FUNDAMENTAL EXPERIMENTS OF SHOWER DEVELOPMENT FOR SPACE USE [UCHUU YOU SHAWA NO KAIHATSU NI KANSURU KISO JIKKEN] **c54**
Noriyuki Takahashi, Kenichi Unno, Kaoru Ootsuji (Mitsubishi Heavy Industries Ltd., Tokyo, Japan), and Takeshi Miyamoto (Mitsubishi Heavy Industries Ltd., Tokyo, Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 8 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

The problems associated with humans living in space have been investigated during past manned flights. The problems fall into two categories: (1) the effects of microgravity on human physiology; and (2) the problem of closed system substance circulation. The specialized equipment that is necessary for closed system substance circulation (equipment for air and water processing, air conditioning, water supply and drainage, and sanitation) is discussed. Data concerning the behavior of water drops in microgravity conditions were obtained utilizing parabolic flight. There are also problems of physical phenomena which relate to gravity (sedimentation) and convection. These problems are primarily concerned with equipment related to water. Possible solutions to these problems may make use of centrifugal force or air flow systems. Author (NASDA)

N92-33759# National Space Development Agency, Tokyo (Japan). Program Planning and Management Dept.
FUTURE SPACE ACTIVITIES CONDUCTED BY THE NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN [NASDA NO SHOURAI NO UCHUU KATSUDOU] **c12**
Youji Shibatou *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 10 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

The present status and future prospects of launch vehicle and sateliite development programs, earth observation programs, and space utilization programs (including participation in international projects), are outlined. Technology development problems related to the following subjects are presented: space transportation systems (space shuttle and orbit transfer vehicles, and manned systems); satellites (scaling-up, increasing electric power supply, and service life); and others (rendezvous and docking, space robot, manned space, and moon and planet development and utilization technologies). Author (NASDA)

N92-33760# National Space Development Agency, Ibaraki (Japan).
UNMANNED MARS EXPLORATION MISSION [MUJIN KASEI TANSA MISSHON] **c12**
Toshihide Maeda *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 24 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Reviews of the unmanned Mars exploration missions and their candidate spacecraft are presented. The results of initial analyses are reported for the following: (1) Mars transfer orbits; (2) launching by H-2 launch vehicles and injection into Mars orbits; and (3) return-to-earth orbits. The purpose, system outline, and necessary equipment are presented for the following spacecraft: (1) Mars Moon Sample Return (MMSR) (from Phobos and Deimos); (2) Mars Landing Explorer (MALE); and (3) Mars Mobile Explorer (MAME). Author (NASDA)

N92-33761# Nissan Motor Co. Ltd., Tokyo (Japan).
MARS EXPLORATION MISSION [KASEI TANSA MISSHON]
Seiji Matsuda *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Mars exploration scenarios are reviewed. An emphasis is placed on scientific exploration. The review and evaluation results are reported for the following items: (1) orbit plans for Mars surface exploration missions that begin in Low Earth Orbit (LEO); (2) powered and aerodynamic capturing payloads from the transfer orbit to a Mars revolving orbit; and (3) a penetrator system as a Mars landing vehicle. Proposed Mars transfer orbits have the following advantages over Hohmann orbits: (1) transfer time and angle are less; (2) the inclination between the orbital planes of Earth and Mars is considered; and (3) velocity variations are not required to change orbit plane. Author (NASDA)

N92-33762# Nippon Electric Co. Ltd., Tokyo (Japan).
MARS REVOLVING OBSERVATION SATELLITE [KASEI SHUUKAI KANSOKU EISEI]
Tsuyoshi Okazaki, Tooru Nakano (Nippon Electric Co. Ltd. Japan), and Masabumi Inomata (Nippon Electric Co. Ltd., Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The features that will be considered for observation on Mars are reviewed. The mission requirements, which are dictated by the features, are discussed. The mission scenarios assume the utilization of the H-2 launch vehicle. Additionally, spacecraft system structures are reviewed. Features that will be considered for observation by Mars satellites are as follows: (1) topographical and geographical features of the Mars surface; (2) material compositions and mineral resources on the Mars surface; (3) composition, pressure, and water vapor content of the Mars atmosphere; (4) vertical structure of the Mars atmosphere; and (5) the climate on Mars (clouds, polarcaps, and sand dusts). Mission operational requirements for exploration vehicle configurations (Mars-oriented and Earth-oriented), including mission equipment installation, onboard data processing, communication, attitude control, electric power source, and solar paddle systems, are reviewed. It is concluded that the Earth-oriented configuration is suitable for high-resolution local topography missions and the Mars-oriented configuration is suitable for atmospheric observation of the Martian surface. Author (NASDA)

N92-33763# Mitsubishi Space Software Corp. (Japan).
ANALYSIS OF SPACECRAFT ENTRY INTO MARS ATMOSPHERE [KASEI TAIKI TOTSUNYUU KAISEKI] **c18**
Ken Nakajima and Koutarou Nagano *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 23 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The effects on a spacecraft body while entering the Martian atmosphere and the resulting design constraints are analyzed. The analyses are conducted using the Viking entry phase restriction conditions and a Mars atmosphere model. Results from analysis conducted by the Program to Optimize Simulated Trajectories (POST) are described. Results obtained from the analysis are as follows: (1) flight times depend greatly on lift-to-drag ratio and less on ballistic coefficients; (2) terminal landing speeds depend greatly on ballistic coefficients and less on lift-to-drag ratios; (3) the dependence of the flight path angles on ballistic coefficients is slightly larger than their dependence on lift-to-drag ratios; (4) as the ballistic coefficients become smaller and the lift-to-drag ratios become larger, the deceleration at high altitude becomes larger; (5) small ballistic coefficients and low lift-to-drag ratios are required to meet the constraints of Mach number at parachute deployment and deployment altitude; and (6) heating rates at stagnation points are dependent on ballistic coefficients. It is presumed that the aerodynamic characteristics will be 0.2 for the lift-to-drag ratio and 75 kg/sq m for the ballistic coefficient for the case of a Mars landing using capsules similar to those used in the Viking program. Author (NASDA)

N92-33764# Toshiba Corp., Tokyo (Japan).
MARS LANDING EXPLORATION MISSION [KASEI CHAKURIKU TANSA MISSHON]
Megumi Suzaki *In* NASDA, Future Space Activities Workshop: Lunar base Workshop 1991 17 Jul. 1991 p 22 In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The overall concept for Mars observation missions and the systems to implement the missions are reviewed. Reviews are conducted on the following items: (1) profiles of the candidate missions; (2) aerodynamic capture deceleration estimates; (3) prospective Mars orbit decisions; (4) landing methods as the prerequisites for mission accomplishment; and (5) explorer systems to accomplish the missions. The major processes involved in the mission, from the launch to the beginning of observation of the surface, are outlined. Reviews of possible orbits taken by the explorer from Mars transfer orbit (Hohmann orbit) to Mars revolving orbit are presented. Additionally, the possible orbits for the landing vehicle from departing from the revolving orbit through landing are presented. Transportation and landing module design concepts concerning the structure, weight, and electric power balances of the explorer system are presented. Critical Mars mission technologies are cited as follows: (1) inter-planet navigation; (2) aerodynamic capture; (3) automatic and autonomous operation; and (4) landing technology. Author (NASDA)

N92-33765# Tokyo Univ. (Japan).
FUNDAMENTAL RESEARCH ON MARS EXPLORATION USING SCIENTIFIC EXPLORATION ROVING VEHICLES [IDOU KAGAKU TANSA SHA O MOCHIITA KASEI TANSA NO KISO KENKYUU]
Nobuki Kawashima, Ichirou Nakatani, Junichirou Kawaguchi, Kouichirou Koyama, Norimi Hasegawa, Shuuzou Kinkori (Nippondenso Co., Kariya, Japan), Manji Suzuki (Nippondenso Co., Kariya, Japan), Masaki Kojima (Nishimatsu Construction Co. Ltd., Tokyo, Japan), Kenji Saitou (Nishimatsu Construction Co. Ltd., Tokyo, Japan), and Tsuguo Adachi (Nishimatsu Construction Co. Ltd., Tokyo, Japan) et al *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 10 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

The following fundamental items concerning Mars scientific exploration roving vehicles are reviewed: (1) special technical aspects; (2) review subjects; (3) purpose of the exploration; (4) methods of underground exploration; (5) other possible methods of scientific exploration; and (6) roving vehicle configuration. Communication between roving vehicles and the Earth, and the stringent environments on Mars are addressed. The driving system, roving distance, and the automatic driving system of the rovers are also presented. Focus is on the underground survey of Mars to check the existence of water or organic substance. The exploration methods covered are as follows: (1) analysis of samples excavated by mechanical drilling; and (2) electromagnetic measurement or sounding using artificial or natural earthquakes in order to explore deeper underground areas where samples can not be obtained by mechanical drilling. Author (NASDA)

N92-33766# Nishimatsu Construction Co. Ltd., Tokyo (Japan).
MARS SCIENTIFIC EXPLORATION ROVING VEHICLES AND DRILLING EQUIPMENT [KASEI IDOU KAGAKU TANSA SHA TO KUSSAKU SOUCHI]
Kenji Saitou, Masaki Kojima, Shuuzou Kinkori (Nippondenso Co., Kariya, Japan), Manji Suzuki (Nippondenso Co., Kariya, Japan), Nobuki Kawashima (Tokyo Univ., Japan), and Ichirou Nakatani (Tokyo Univ., Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Running gears for the Mars scientific exploration roving vehicles and the drilling equipment for the vehicles used to conduct underground exploration are studied. Review results on moving, driving, and running system for the vehicle are presented. For the driving system, comparison between conventional wheel system and crawler system are shown in a comprehensive table, and measures for failures are suggested. As for the development of the drilling equipment, the following items are presented: (1) methods of underground exploration; (2) methods of drilling (core boring and auger boring); (3) specifications for and the results of trial production of the experimental boring machine; (4) results of experimental boring machine operation on a simulated Mars surface; and (5) excavating capability of the experimental boring machine. Author (NASDA)

N92-33767# Toshiba Corp., Tokyo (Japan).
REVIEW ON PHOBOS SAMPLE RETRIEVAL MISSION [FOBOSU SANPURU KAISHUU MISSHON NO KENTOU]
Nobuaki Nagaoka *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The purpose of the Phobos sample collection mission is to rendezvous with the Mars satellite Phobos, conduct observation of its surface, and collect and return samples to the Earth. The sample return satellite for achieving the mission will be injected into the Mars revolving orbit by a H-2 launch vehicle and an Orbit Transfer Vehicle (OTV). The satellite will stay on the Phobos surface till the Earth and Mars are in favorable positions relative to each other. Reviews are conducted on the following items: (1) onboard mission equipment; (2) the mission profile of injection into the revolving orbit of Mars, access to and landing on Phobos, and sample return to the Earth; (3) methods of fixing the satellite on the surface of Phobos; and (4) sample retrieving to the Earth. The following subsystems of the satellite system are reviewed: (1) the electric power subsystem; (2) the data processing communication subsystem; (3) the attitude and orbit control subsystem; (4) the propulsion subsystem; (5) the thermal control subsystem; (6) the structure subsystem; (7) the sample retrieving probe; and (8) the satellite configuration. Author (NASDA)

N92-33768# Fuji Heavy Industries Ltd., Utsunomiya (Japan).
INTERNATIONAL ASTEROID MISSION (IAM) [IAM (INTANASHONARU ASUTEROIDO MISSHON) NI TSUITE]
Ryuuji Yamaguchi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

International Asteroid Mission (IAM) is a program aimed at developing resources of asteroids abundantly existing near the earth. This report describes the research results of design project of the International Space University (ISU) held in 1990 at Tront-York University. ISU research and asteroid survey results, and the manned asteroid mining mission are outlined. Classification of asteroids existing near the earth and asteroid resource processing and use analyses are conducted. Asteroid selection flow charts are introduced, and the 1982HR-Orpheus is selected as a candidate asteroid because it takes an approaching orbit toward the earth, requires small delta V, and possesses abundant carbonaceous chondrites. Characteristics of 1982HR-Orpheus are presented. Mission requirements, mission outlines, transportation systems, and mining and processing systems for manned asteroid mining missions are presented. Author (NASDA)

N92-33769# National Space Development Agency, Tokyo (Japan).
REVIEW ON UNMANNED LUNAR EXPLORATION MISSION [MUJIN TSUKI TANSA MISSHON NO KENTOU]
Yutaka Kaneko *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 26 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Advance survey by unmanned exploration using robots is mandatory for the future manned lunar surface activities to be accomplished more safely and at a lower cost. Reviews are conducted on the following spacecraft to implement such unmanned mission by the Launch Vehicle and Satellite System Laboratory in Tsukuba Space Center: (1) moon revolving

observation satellites; (2) lunar roving vehicles; (3) lunar hoppers; (4) a sample retrieval system; (5) a lunar landing module; and (6) lunar data relay satellites. Spacecraft involved in unmanned lunar exploration missions are outlined. Major characteristics and system structure of the lunar landing module are presented. The major feature, weight and electric power balances of the lunar roving vehicles, system configuration, structure, weight, electric power balances, flight paths, and major characteristics of lunar hoppers are also presented. System structure and weight estimates are indicated. Author (NASDA)

N92-33770# Nissan Motor Co. Ltd., Tokyo (Japan).
LUNAR EXPLORATION MISSION [TSUKI TANSA MISSHON]
Youko Nishio *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 18 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Manned lunar surface sites for manned missions, and lunar landing modules and roving vehicles for unmanned missions are reviewed. System requirements for lunar surface sites and their system structures are presented. Prerequisites and mission review results, landing orbits, thruster thrust, necessary delta V, and weight and electric power balances of the landing module are presented. The research and development elements for lunar landing modules are: (1) landing guidance technology; (2) development of landing gears; and (3) propulsion systems for landing. The missions, system review results, operation methods, and operation concepts of lunar roving vehicles are indicated. Research and development elements for lunar roving vehicles are: (1) running system (including wheels); (2) remote operation; and (3) autonomous driving technology. Author (NASDA)

N92-33771# Mitsubishi Space Software Corp. (Japan).
LUNAR SOFT LANDING ORBIT DESIGN [TSUKI NANCHAKURIKU KIDOU SEKKEI]
Ken Nakajima and Koutarou Nagano *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 21 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The following subjects necessary for lunar soft landing orbit design are reviewed: (1) methods to solve minimum fuel consumption problems; (2) lunar soft landing orbit design based on the results of the fuel consumption problems; and (3) future problems. The answer to the minimum fuel consumption by Pontryagin's maximum principle are presented. Lunar soft landing orbit design using a spherical model are presented for four assumed cases. Powered descending time-altitude profile, transient angle-altitude profile, powered descending time-vertical speed profile, powered descending time-control angle profile, and powered descending time-speed profile in down-range direction are showed. The following has become clear: (1) when powered descent begins from an elliptical orbit, starting from the perigee point is advantageous if the speed increase necessary for landing is employed as the criteria; and (2) constant thrust acceleration level exists to minimize necessary speed increase. Author (NASDA)

N92-33772# Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan).
REVIEW ON UNMANNED LUNAR LANDING MODULES LIFTED OFF BY H-2 LAUNCH VEHICLES [H-2 NI YORU MUJIN GETSUMEN CHAKURIKU KI NO KENTOU]
Shunichirou Nakai, Tetsuya Nakamura, Yukihito Kitazawa, and Kazuyuki Higashino *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 19 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A review is conducted on unmanned lunar landing modules lifted off by H-2 launch vehicles to accomplish various missions on the lunar surface as the lead to manned lunar exploration. Results of mission trade-offs are presented, based on the assumption of conducting at least each one mission with and without roving vehicles, and one sample return mission, if possible. Detailed mission trade-offs for environment, geology, underground structure, and ground characteristic survey missions are presented, and an unmanned lunar landing module mission structure is exemplified. Operation plans up to arrival at the moon and after the arrival are introduced. Results of system reviews on operation plans, system structures, system function distributions, and subsystem reviews on propulsion, structures, thermal control, electric power, navigation, and guidance subsystems are presented. Reviews on configurations and development plans are also presented. Author (NASDA)

N92-33773# Hitachi Ltd., Tokyo (Japan).
CONCEPTUAL DESIGN OF LUNAR LANDING MODULE [GETSUMEN CHAKURIKU KI NO GAINEN SEKKEI]
Takeshi Kawazoe, Toshiyuki Tanaka, Kouhei Katou, Kazuhisa Kaneko, and Masaya Yamamoto *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 23 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Analyses on mission operations and systems for lunar landing modules are conducted. The results of the review are presented. The main subjects of the review are as follows: (1) mission operation analyses (orbits); (2) attitudes; (3) methods of detecting the barrier at landing; (4) stability at landing; (5) system configurations, weight, and power balances; (6) main propulsion system thrust and speed increments; (7) weight and electric power analyses; (8) thermal analyses; (9) communication circuits; (10) payload interfaces; (11) on-ground systems; (12) assembly methods; and (13) subsystems. Sequences up to landing on the moon are introduced as follows: (1) launch to lunar transfer orbit; (2) mid-course maneuver; (3) entry into lunar gravity range; (4) deceleration before entering lunar rotating orbit; (5) getting on the lunar rotating orbit; (6) descending maneuvering to land on the moon; (7) getting on the lunar descending orbit; (8) throttling to hovering thrust; (9) hovering at an altitude of 100 km; and (10) stopping the engine to land on the moon at an altitude of several meters. Author (NASDA)

N92-33774# Toshiba Corp., Kawasaki (Japan). Komukai Works.
MISSIONS AND SYSTEMS FOR LUNAR ROVING VEHICLES [GETSUMEN IDOU TANSA KI NO MISSHON TO SHISUTEMU]
Hiroshi Tomita *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 14 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Studies on missions and systems of lunar roving vehicles are conducted to compensate for the defects of unmanned lunar landing modules. Results of the reviews on system requirements, exploration scenarios, and outlines of their operations are presented. The results of system reviews on navigation and guidance, and communication and lunar data relay satellites are introduced. Outlooks of mission equipment, candidate exploration courses, visible conditions, and exploration activities profiles are presented. Configuration, functional chart, GN&C (Guidance, Navigation and Control) functional requirements of lunar roving vehicle, and lunar data relay satellite configuration and their orbit are also introduced. Since lunar roving vehicle technology involves most of the technologies necessary for Japan's future space development such as lunar and planet exploration, remote control, and autonomous and intelligent robot technologies, it is hoped that the space development capability level will be developed rapidly. Author (NASDA)

N92-33775# Remote Sensing Technology Center, Tokyo (Japan).
REVIEW ON LUNAR EXPLORATION MISSIONS REQUIREMENTS Report No. 3 [TSUKI TANSA MISSHON YOUKYUU NO KENTOU]
Hajime Koshiishi and Natsuhiko Motomura *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul.

1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A detailed review is conducted on the observation specifications of remote sensors and related items required for lunar remote sensing missions. Observation objectives, equipment specifications, combination, and expected observation results for the following sensors are presented: (1) a fluorescent x-ray spectrometer; (2) a gamma ray spectrometer; (3) a mapping camera and telephotocamera; (4) a high-resolution stereocamera; (5) an ultraviolet, visible, and short wavelength infrared imaging spectrometer; (6) a thermal infrared radiometer and spectrometer; (7) a microwave radiometer; (8) a synthetic aperture radar; (9) a laser altimeter; and (10) a magnetometer. As related items, relay satellites and radio source on lunar surface are introduced. Recent foreign trends in exploration of the Moon, Venus, Mars, asteroids, Jupiter, and Saturn and equipment necessary for those missions are also reviewed. Author (NASDA)

N92-33776# National Space Development Agency, Tokyo (Japan).
EXPERIMENT CONCEPTS AT MANNED LUNAR SURFACE SITES [YUUJIN GETSUMEN KYOTEN NI OKERU JIKKEN GAINEN]
Tsutomu Iwata *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 5 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A01/MF A10

The purpose of manned lunar surface sites is to experiment the feasibility of human activities on the lunar surface. The experiments will be conducted by three crews staying for ten day intervals in the module to verify habitation technology on the moon, to study scientific researches, and to research the development and utilization technologies of lunar surface. It is necessary to include the following elements in the experiments conducted on the manned lunar surface sites: (1) safe human shuttling to the lunar surface; (2) more than a ten day stay by people; (3) scientific exploration on lunar surface; (4) life science; (5) astronomical, space science, and physical experiments; (6) utilization experiments of lunar resources; and (7) construction technology experiments for lunar bases. Author (NASDA)

N92-33777# Mitsubishi Electric Corp., Tokyo (Japan).
PROCEDURES FOR INITIAL SETTING UP MANNED LUNAR SURFACE SITES [YUUJIN GETSUMEN KYOTEN NO SHOKI TACHIAGE TEJUN NI TSUITE]
Katsutoshi Oomura *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 13 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Ideas to solve technical problems in constructing manned lunar surface sites such as energy supply, cartography of an accurate lunar surface map, connecting techniques of lunar modules, problem of life support, and standardization of OTV (Orbit Transfer Vehicle) and lunar landing modules are described. As a countermeasure for energy supply and lunar map cartography, the initial installation of large scale energy module and lunar roving vehicle ('lunar bulldozer') on the site are proposed respectively. For connecting lunar modules, the technology seems to be available to make a moving attachment to the lunar modules. For the life support problem, it seems to be useful to apply life support system and environmental control techniques for closed environment on the earth. Author (NASDA)

N92-33778# Nippon Electric Co. Ltd., Tokyo (Japan).
CONSTRUCTION OF MANNED LUNAR SURFACE SITES BY ROBOTS [ROBOTTO NI YORU YUUJIN GETSUMEN KYOTEN NO KOUCHIKU] **c31**
Toshiaki Okudaira, Kazuhide Todome, and Junko Takahashi (Nippon Electric Co. Ltd., Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 19 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Manned lunar surface site is the smallest manned system for staying, constructed on lunar surface prior to constructing permanent lunar bases with minimum function. This report describes the results of reviews on initial construction, system setting up, and lunar surface operation robots required most critically for those activities. Functional requirements for manned lunar surface sites are described. Lunar surface site construction by robots are outlined. System structure, weight and electric power balances, and construction flow are also outlined. Author (NASDA)

N92-33779# Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan).
CONSTRUCTION OF MANNED LUNAR SURFACE SITES [YUUJIN GETSUMEN KYOTEN NO KOUCHIKU] **c31**
Yoshinori Yuzawa, Michihiko Horie, Tetsuya Nakamura, Raita Amagata, and Tetsuya Honda *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 21 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A review is conducted on manned lunar surface sites to be constructed in around 2010 to conduct various experiments and observations on the lunar surface in a short time prior to developing permanent lunar bases. Methods of construction and operation of manned lunar surface sites are established, taking requirements from the mission parts and shipping mean constraints. Review results of mission requirements and operation profiles are presented. Experiment subjects, structures and outlines of subsystems, weight balance, electric power balance and functional block diagram of the manned lunar surface sites are presented. Conceptual drawings of air-lock and roving vehicle, operation profiles and conceptual drawing of lunar surface sites are shown. Author (NASDA)

N92-33780# Nippon Electric Co. Ltd., Tokyo (Japan).
ECLSS EXPERIMENTS AT MANNED LUNAR SURFACE SITES [GETSUMEN YUUJIN KYOTEN NI OKERU ECLSS JIKKEN] **c54**
Toshimitsu Kanemura, Jun Inagaki, and Shigeru Oono *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 19 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Conceptual study of ECLSS (Environmental Control and Life Support System) experiment plans and equipment for developing water recycling technology, one of the technologies which constitute the base for constructing the foundation for enlargement of lunar surface human activities, is conducted. Experiment subjects are as follows: (1) water processing experiments to find out if human waste excreted by the crew can be processed using aerobic microorganisms originally existing in the waste; (2) physical and chemical water processing experiments to conduct tests to verify the drainage processing capability of the water recycling processes focussing on membrane process; and (3) an experiment of substance utilization derived from water recycling process (surplus sludge, concentrated waste). The aim is to bring the material back to earth. Plans of experiments, system concepts, system structures and system flow chart are illustrated, and methods of shipment, operation and maintenance, and safety of the system are outlined. Function and performance of subsystems such as electric power supply, gas supply, control and data processing, thermal control, organism processing, and physical and chemical processing experiment subsystems are also presented. Author (NASDA)

N92-33781# Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan).
LUNAR SURFACE EXPERIMENT PLANS [GETSUMEN JIKKEN KEIKAKU]
Seiko Hoshi, Masakazu Takami, and Keiko Yasuda *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991

17 Jul. 1991 20 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A conceptual study is conducted on selection of experiment missions and lunar surface experiment systems to conduct scientific experiments at manned lunar surface sites, which are regarded as advance posts for verifying the feasibility of human activities and lunar resource utilization. The 22 lunar surface experiment model missions selected from the whole space utilization missions are roughly classified as follows: (1) lunar exploration mission; (2) life science mission; (3) material production mission; (4) 1/6 g mission; (5) high-vacuum application mission; (6) astronomical observation mission; and (7) radiation environment utilization mission. The results of the system review on experiment site locations, pressurized environmental testing system, lunar surface experiment systems (nearby module experiment section and remote spot experiment section), system resource analyses and operation are outlined. Interfaces between lunar surface experiment system and subsystems constituting manned lunar surface sites, material experiment flow chart of pressurized environment experiment system, nearby module experiment and remote spot experiment sections, resource analysis and technical problems in developing lunar surface experiment systems are presented.

Author (NASDA)

N92-33782# Toshiba Corp., Tokyo (Japan).
REVIEW ON HABITABILITY AT MANNED LUNAR SURFACE SITES [YUUJIN GETSUMEN KYOTEN NI OKERU KYOJUUSEI NO KENTOU] **c54**
Kouichi Furukawa *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 15 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A review is conducted on the habitability of a module to accommodate the short-time (ten sunlit days, maximum 15 days) stay of three crews at manned lunar surface sites to be used for various experiments and observations. Prerequisites for review are: (1) constructed in around 2010; (2) stay time is ten sunlit days and 15 days at the maximum; (3) constructed at the east side of equator facing at the earth; (4) lunar landing weight per one flight is within ten tons; (5) operation for three years twice per year; (6) consumed materials (water, oxygen, foods, etc.) are expendable; and (7) every crew is given one room. Pressurized module, sizings (constraints by launch vehicles dimensions, ceiling height for expected body statures of white race and the floor spaces and volumes of rooms of the pressurized module), layout, weights and electric power of room spaces of the living module are outlined. Configurations of overall lunar surface sites and living modules are conceptually displayed in drawings. Author (NASDA)

N92-33783# Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON LUNAR SURFACE OPERATION ROBOTS [GETSUMEN SAGYOU ROBOTTO NO KENTOU] **c37**
Michiaki Mizuochi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 22 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A review is given of robots to conduct construction of lunar surface sites, to layout each subsystem, and to support lunar surface experiments performed as the first step to set up a concept of lunar bases. The robots' mission requirements and the system review baselines were studied based on the following premises for their missions: (1) to support manned lunar surface sites construction; (2) to transport, install, and connect piping and wiring heavy goods being laid out in inhabited module or drive self-propelled items; (3) to be used only during day time; and (4) to be used from the initial stage of construction of manned lunar surface sites. The results of the review were presented, and the requirements, the baselines for their review, system structure and composition, main features, electric system chart, and development plans of lunar surface robots are shown. Technical problems to be solved such as stereoscopic image processing and seven degree of freedom control technology for manipulators are presented. Observation equipment to be operated by the robots on the lunar surface are: (1) radio, visible and infrared, and x-ray telescopes; (2) environment monitoring equipment; (3) lunar seismometer; and (4) thermal flow meter. Author (NASDA)

N92-33784# Obayashi Corp., Tokyo (Japan).
PRODUCTION OF CONSTRUCTION MATERIALS FOR LUNAR BASES Report No. 1 [GETSUMEN KICHI NO TAME NO KENSETSU ZAIRYOU NO SEISAKU] **c31**
Youji Ishikawa, Tetsumi Higasayama, Tetsuo Sasaki, Yukio Shimizu (Tokyo Univ., Japan), and Kyouichi Kuriki (Tokyo Univ., Japan) *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 16 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Research was conducted to verify what construction materials can be produced on the lunar or Mars surface. Soil simulation of lunar or Mars surfaces is produced, and heating and melting experiments by microwave are conducted. Experiment equipment consisting of a microwave generator, power monitor, crucibles, and thermometer are outlined. Experiment parameters, measured temperatures, and melting and radiation energy obtained by calculations are presented. Block production experiments by cold pressing are also conducted. Experiment equipment, material composition conditions, and the results of experiments are outlined. Block production using microwave heating is compared with other production techniques. The possibility of producing construction materials from soils on lunar or Mars surfaces was verified, and it was suggested that they can be used for constructing structures on lunar or Mars surfaces. Author (NASDA)

N92-33785# Shimizu Corp. (Japan).
STRUCTURES AND CONSTRUCTION OF NUCLEAR POWER PLANTS ON LUNAR SURFACE [GETSUMEN NI OKERU GENSHI RO TATEYA NO KOUZOU TO SEKOU] **c31**
Katsunori Shimizu, Masuhiko Kobatake, Sachio Ogawa, Hiroshi Kanamori, Yasuhiko Okada, Hideyuki Mano, and Kenji Takagi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The best structure and construction techniques of nuclear power plants in the severe environments on the lunar surface are studied. Facility construction types (functional conditions such as stable structure, shield thickness, maintainability, safety distances, and service life), construction conditions (such as construction methods, construction equipment, number of personnel, time required for construction, external power supply, and required transportation) and construction feasibility (construction method, reactor transportation between the moon and the earth, ground excavation for installation, loading and unloading, transportation, and installation, filling up the ground, electric power supply of plant S (300 kW class) and plant L (3000 kW class)) are outlined. Items to pay attention to in construction are (1) automation and robotization of construction; (2) cost reduction by multi functional robots; and (3) methods of supplying power to robots. A precast concrete block manufacturing plant is also outlined.

Author (NASDA)

N92-33786# Takenaka Works, Osaka (Japan). Technical Research Lab.
EXPERIMENTAL STUDY ON LUNAR UNDERGROUND BASE CONSTRUCTION BY GAS BALLOON METHOD [GASU BARUN KOUHOU NI YORU GETSUMEN CHIKA KICHI NO KENSETSU HOUHOU NO JIKKEN TEKI KENTOU] **c31**
Toshio Saitou, Takatoshi Ogawa, Katsutoshi Asai, and Yasushi Nakayama *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 9 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

The pressure forming property of superplastic alloys expected to be of practical use as materials for gas balloon method is studied. Results of reviews on pressure forming property and

application to the gas balloon method of superplastic alloys, and experiment plans for formulating spaces in environments simulating those in the lunar underground are outlined. The following topics are described: (1) fundamental concept of gas balloon method; (2) method to evaluate the workability of superplastic alloys; (3) effects of pressure control accuracy on the workability of superplastic alloys; and (4) an example of pressure and temperature control pattern for dome formation with superplastic alloys.
Author (NASDA)

N92-33787# National Space Development Agency, Tokyo (Japan). System Engineering Dept.
FUTURE TRANSPORTATION SYSTEMS [SHOURAI GATA YUSOU KEI NI TSUITE] **c16**
Takao Etou *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 12 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A study was made of fly-back boosters as one future space transportation system. After presenting premises for review such as launch date, launch site, system configurations, numbers of reuse, and system structure, the following topics were discussed: speed increments, specific impulse, structural efficiency, sizing, performance balance optimization, and configurations. Comparison of various Japanese launch vehicles, relationship between lifted weight and payload weight, between propellant weight and tank length, performance balance optimization, and candidate configurations are presented with tables and charts. Separation speed of the booster is a problem peculiar to the fly-back booster. Reentry conditions and landing place are determined by the separation speed.
Author (NASDA)

N92-33788# Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON ORBIT TRANSFER VEHICLES TO BE LAUNCHED BY H-2 LAUNCH VEHICLES [H-2 ROKETTO TOUSAI GATA KIDOU KAN YUSOU KI NO KENTOU] **c16**
Takahiro Itou *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Results of the review on the Orbit Transfer Vehicle (OTV) to be launched by H-2 launch vehicles are presented. The prerequisites, including transportation profiles, necessary speed increments from the earth to the moon, comparison of transportation capabilities in unmanned lunar exploration phase of the OTV's, conceptual study and examples of the mission such as lunar landing, lunar sample return, and earth geostationary orbit injection, are outlined. Conceptual drawings and major characteristics of the OTV propulsion systems, power and weight balance (for lunar transfer orbit injection), and 4.1 tons and 1.6 tons class lunar landing vehicles are presented.
Author (NASDA)

N92-33789# Hitachi Ltd., Tokyo (Japan).
CONCEPTUAL STUDY ON ORBIT TRANSFER VEHICLE LAUNCHED BY H-2 LAUNCH VEHICLES [H-2 ROKETTO YOU KIDOU KAN YUSOU KI NO GAINEN SEKKEI] **c16**
Kouhei Katou, Masaya Yamamoto, Takeshi Kawazoe, Kazuhisa Kaneko, and Toshiyuki Tanaka *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A conceptual study of the Orbit Transfer Vehicle (OTV) is conducted on the overall systems and propulsion systems. The premises for the study are: (1) OTV is mounted on the 2nd-stage of an H-2 launch vehicle and injected into Low Earth Orbit (LEO); and (2) OTV can be used for multiple missions such as lunar and planet exploration and geostationary missions. The results of orbit calculation for several missions are shown, and the system features, mass and power balance, and system structure of the OTV are presented. The results of reviews on the transportation capability, types of engine (specific impulse, thrust, and engine cycles), and performance and characteristics of main propulsion system are outlined. Main technical problems to be solved for realizing the propulsion system are: (1) high performance turbopump and heat exchanger development for LOX/LH2 expander cycle engine; and (2) engine low expansion section and deployment mechanism.
Author (NASDA)

N92-33790# Nissan Motor Co. Ltd., Tokyo (Japan).
FLY-BACK BOOSTERS [FURAI BAKKU BUSUTA] **c20**
Takashi Makino and Seiji Matsuda *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 13 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The first system review on rocket systems composed of fly-back booster and expendable upper-stage rockets which are capable of launching a payload of 30 tons into low earth orbit is conducted. Three types of winged reusable fly-back booster systems are reviewed on the following premises: (1) payload launch capability of 30 tons; (2) start of operation in the years 2000 to 2010; (3) two-staged vertically launched vehicles; and (4) the core will be a LH2/LOX two-stage launch vehicle with LE-7A rocket engines. 2nd-stage fundamental features, booster stage aerodynamic design, aerodynamic performance estimates, booster stage sizing, orbit analysis, and system trade-off of the fly-back boosters are reviewed. Fly-back booster launch vehicle flight sequence, 2nd-stage features, configuration and characteristics of three types of rocket system, and fly-back booster orbit condition histories are outlined.
Author (NASDA)

N92-33791# Kawasaki Heavy Industries Ltd., Kobe (Japan). Aerospace Group.
CONCEPTUAL STUDY ON VERTICALLY LAUNCHED FLY-BACK BOOSTERS [SUICHOKU UCHIAGE HOUSHIKI FURAI BAKKU BUSUTA NO GAINEN KENTOU] **c20**
Kouichi Yonemoto and Takashi Mugitani *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 23 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A conceptual study is conducted of fly-back boosters as the proposed candidates for future transportation systems which can be realized in the near future. System design requirements such as policy and scope of design study are reviewed. Conceptual design of the body such as the design flow and design conditions, optimization of performance sharing between fly-back boosters and upper-stage rockets, body configurations, weight estimates and weight balance of the body, trade-off of candidate optimized configurations, and flight profiles is conducted. Baselines and candidates of configuration, required performance, weights of engines for cruising, and dimensions of the body are presented. Results of body weight analyses, and flight profiles are also presented.
Author (NASDA)

N92-33792# Mitsubishi Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON TRANSPORTATION SYSTEMS FOR MANNED LUNAR MISSIONS [YUUJIN TSUKI MISSHON NI KANSURU YUSOU SHISUTEMU NO KENTOU] **c16**
Takahiro Itou *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 14 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A transportation system from earth revolving orbits to the lunar surface, to be used in the manned lunar surface sites phase, in which three astronauts stay at the site during day time only, is reviewed. The review examines the system functional balance between composing elements and selection of the overall manned lunar transportation system and on subsystems such as manned transportation module, lunar landing vehicle, and lunar transportation vehicle. The following topics are covered: (1) representative example of earth-moon transportation profiles and required speed increments; (2) overall lunar transportation system structures; (3) functional balance between subsystems; (4) outline

characteristics of manned transportation module; and (5) conceptual drawings and outline characteristics of lunar landing and take-off, and lunar transport vehicles. Author (NASDA)

N92-33793# Fuji Heavy Industries Ltd., Tokyo (Japan).
REVIEW ON OPERATION CONCEPTS AND SEPARATION SIMULATION OF M-5 ROCKET VEHICLE AIR-LAUNCH PROGRAM [M-5 ROKETTO KUUCHUU HASSHA KEIKAKU NO UNYOU KOUSOU OYOBI RIDATSU SHIMYURESHON NO KENTOU] **c18**
Tadashi Ishikawa, Hidehiro Hirose, Yasuhiro Tani, and Yousuke Nagao *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 17 p In JAPANESE Prepared in cooperation with Tokyo Univ., Japan and Nissan Motor Co. Ltd., Tokyo, Japan (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

This report reviews the methods to load and separate the M-5 air-launched rocket vehicle from the mother plane. Comparison of the features, merits, demerits, and separation profiles of the M-5 air-launched rocket vehicle with those of the U.S. air-launched rocket vehicle 'Pegasus' are made. The feasibility of separation from the mother plane is verified by simulation. Author (NASDA)

N92-33794# Power Reactor and Nuclear Fuel Development Corp., Oarai (Japan).
STUDY OF POTASSIUM TURBINE ELECTRIC GENERATOR SYSTEM [KARIUMU TABIN HATSUDEN SHISUTEMU NO KENTOU] **c44**
Hiroshi Seino, Kazuo Haga, Hajime Kataoka, and Akira Ootsubo *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 31 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Structures and weight of the heat radiator panels (including heat pipes) and condensers as major constituent elements of the potassium Rankine cycle electric power generator systems of 300 kW output are reviewed and evaluated. An overall circuit diagram, major specifications, structure, weight, and heat transfer performance of the potassium Rankine cycle electric power generator system are estimated. Protection of radiator panels (including radiator fins and heat pipes) from meteoroids, structure and weight estimate of the potassium condensers are also described. Physical property trade-off of radiator fin materials, compatibility between metallic and alkaline materials, and potassium Rankine cycle circuit diagram are presented. The problems to be solved in the future are: (1) detailed examination of material strength to reduce structure weight; (2) methods of melting potassium or sodium for starting the system; (3) methods of supporting equipment taking into consideration the absorption of thermal expansion and acceleration (max. 8 g); (4) ensuring flow stability in the condenser; and (5) verification of relationship between heat transfer and pressure loss used in the design. Author (NASDA)

N92-33795# Institute for Future Technology, Tokyo (Japan).
STUDY COMMITTEE ON LUNAR BASES AND LUNAR RESOURCE DEVELOPMENT: RESULTS AND SUBJECTS [GETSUMEN KICHI TO TSUKI SHIGEN KAIHATSU KENKYUU KAI NI TSUITE: SEIKA TO KADAI]
Hiroo Hieda *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 13 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Study on lunar bases and lunar resource development is conducted by a committee which consists of more than 200 researchers. Results of the study are outlined on the following subjects: (1) fundamental reviews of the study; (2) establishment of research concepts; (3) fundamental reviews of space resource utilization; (4) reviews of lunar surface development and space theory; (5) phased development of lunar bases; (6) phased development of lunar activities and detail of activities in each phase; (7) major technologies required for lunar base construction; (8) conceptual design of D-He-3 nuclear reactors; (9) roles played by lunar bases in Mars exploration; and (10) ground test equipment. The results are summarized as follows: (1) practical scenarios of lunar base realization are shown and the feasibility of initial-stage manned lunar base with Japanese technology is made clear; (2) feasibility of visible radiation interferometer (lunar astronomical observatory) with a resolution of 1/100,000 second can be made clear; (3) major research and development problems on core technologies indispensable to construct lunar bases such as closed ecological life support system, robot, space transportation, and energy supply technologies; (4) existance of lunar resources such as D-He-3, solar wind gas, and metals and problems required for utilizing those resources are made clear; (5) it is shown that D-He-3 nuclear fusion has higher economy, safety, and environment maintainability than D-He-3 laser nuclear fusion; and (6) test equipment which should be subjected to rapid start for constructing lunar bases is identified. Author (NASDA)

N92-33796# National Space Development Agency, Ibaraki (Japan). Launch Vehicle and Satellite System Lab.
FEASIBILITY OF MICROMINIATURE SATELLITES [CHOU KOGATA EISEI NO KANOU SEI NI TSUITE] **c18**
Ryouichi Imai *In its* Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 20 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

A conceptual study is conducted on technical problems and system design techniques to accomplish higher performance microminiature satellites by smaller systems. Applications of microminiature satellite technology to practical satellite mission are mentioned. Concepts of microminiature satellites, measures to miniaturize satellites, and micro-miniaturization technologies for communication and data processing, electric solar power paddle, attitude and orbit control, structure, thermal control, propulsion, and instrumentation systems are outlined. Examples of miniaturizing satellite missions such as planet exploration, low-altitude communication networks, space positioning system, low-altitude earth observation mission, clustered satellites, tethered satellites, and timely observation are described. Satellite miniaturizing technology can also be used to launch systems by lasers, and superconductive linear catapults (space escalator). It is pointed out that keys to promote satellite miniaturization are electronics, precision machining, raw material, electric power source technologies, and system design technology to integrate those technologies. Author (NASDA)

N92-33797# Mitsubishi Electric Corp., Tokyo (Japan).
STUDY ON MINIATURIZATION OF SATELLITES [EISEI KOGATA KA NO KENTOU] **c18**
Hiroaki Obara, Katsutoshi Oomura, and Osamu Saitou *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 21 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

Problems in designing miniaturized satellite systems consisting of miniaturized constituent elements and missions suitable to miniaturized satellites, and subjects of technical development available for miniaturization are examined and reviewed. Results of reviews on satellite miniaturization of the following subsystems are outlined: (1) communication and data processing subsystem; (2) electric power supply; (3) sensors (optical and inertial sensors, and GPS (Global Positioning System) receivers) and actuators (wheels, RCSs (Reaction Control Subsystem)); and (4) structure and thermal control subsystem. Problems in designing the system are: (1) introduction of commercialized goods technology; (2) anti-space environment measures; (3) user friendly operation system; and (4) disposal of used satellites. Miniaturized satellite utilization missions considered are: (1) technology development mission (scientific and engineering experiments); (2) communication and positioning mission; (3) observation mission; and (4) planet exploration mission. Author (NASDA)

N92-33798# CSP Japan, Inc., Tokyo.
INTERNATIONAL COOPERATION AND JAPAN'S ROLE IN LUNAR AND PLANET EXPLOITATION [TSUKI, WAKUSEI KAIHATSU NI OKERU KOKUSAI KYOURYOKU TO NIHON NO YAKUWARI] c84
Tomoko Iguchi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 19 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A03/MF A10

The necessity, present status, and future possibility of international cooperation and Japan's role in space development activities on the moon and other celestial bodies within the solar system are studied. The results of the study on the definition of the moon and other celestial bodies and the value of their resources are outlined. It is pointed out that the way of exploration activities on those celestial bodies largely depends on their resources. Lunar utilization projects in the U.S. and Japan are outlined. In the U.S., usefulness of the lunar utilization is divided as a celestial body land and as resources. The former is the lunar exploration as the first step of other celestial body utilization and the latter is the utilization for space colony, solar power system, and helium-3 resource. The way of international cooperation in the exploration activities and necessity of legislative system are discussed. Technology transfer measures, and establishment of a development fund and an international consortium are presented as a guideline for development of a system and international cooperation.
Author (NASDA)

N92-33799# Shimizu Corp. (Japan). Space Project Office.
ESTABLISHMENT OF LEGISLATIVE SYSTEM FOR SPACE COMMERCIALIZATION [UCHUU SHOUGYOU KA NI OKERU HOU SEIDO NO SEIBI] c84
Kazuya Fushimi *In* NASDA, Future Space Activities Workshop: Lunar Base Workshop 1991 17 Jul. 1991 9 p In JAPANESE (For primary document see N92-33753 24-91)
Avail: CASI HC A02/MF A10

The way to realize the commercial use of space environments is studied from perspectives of practical business area after conducting discovery and analysis of problems recognizing that space activities are born under industrial structures of a capitalism economy and power structure generated in the political background. The results of the study on human activities and the necessity of their order, evaluation of space development and related problems, and establishment of legislative system for commercial use of space environment are outlined. Author (NASDA)

N92-34061# European Space Agency, Paris (France).
PHOTOMETRIC ANALYSES FOR THE DETERMINATION OF PHYSICAL AND STRUCTURAL PROPERTIES OF THE MARTIAN SURFACE IN THE OXIA PALUS REGION Ph.D. Thesis - Ludwig-Maximilians-Univ. [PHOTOMETRISCHE UNTERSUCHUNGEN ZUR BESTIMMUNGPHYSIKALISCH-STRUKTURELLER EIGENSCHAFTEN DER MARSOBERFLAECHE IM GEBIET OXIA PALUS]
Peter Regner (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, Germany, F.R.) Mar. 1992 244 p Transl. into GERMAN of Photometrische Untersuchungen zur Bestimmungphysikalisch-Struktureller Eigenschaften der Marsoberflaeche im Gebiet Oxia Palus (Oberpfaffenhofen, Fed. Republic of Germany, DLR), Jun. 1990 p 177 Original language document was announced as N91-16979
(ESA-TT-1248; DLR-FB-90-27; ETN-92-91964) Avail: CASI HC A11/MF A03; DLR, Wissenschaftliches Berichtswesen, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC

The photometric function derived analytically by Hapke (1986) is applied to photometric measurements in the Oxia Palus region of Mars in order to gain insight into the physical and structural properties of the terrain materials in this area, their wavelength dependence, and spatial distribution. The photometric evaluation is based on measurements of the surface reflectance for different phase angles in 325 training areas, selected on the basis of color enhanced Viking orbiter images. The method can be extended to all planetary objects having rough (vegetation free) surfaces, for which multidirectional remote sensing observations are available.
ESA

N92-33311*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
LUNAR RESOURCE MAPPER/LUNAR GEODETIC SCOUT PROGRAM STATUS
Mike Conley *In its* Third SEI Technical Interchange: Proceedings 1992 p 9-15 (For primary document see N92-33309 24-12)
Avail: CASI HC A02/MF A05

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

N92-33710# Los Alamos National Lab., NM.
CORONAL MASS EJECTIONS AND GEOMAGNETIC STORMS: SEASONAL VARIATIONS
J. L. Phillips, J. T. Gosling, and D. J. McComas 1992 9 p Presented at the Solar-Terrestrial Predictions Workshop, Ottawa (Canada), 18-22 May 1992
(DE92-015141; LA-UR-92-1616; CONF-9205201-1) Avail: CASI HC A02/MF A01

The well-established semiannual geomagnetic cycle, with peak activity near the equinoxes, has been attributed to the angle between the solar rotation axis and the geomagnetic dipole, which modulates the GSM Bz component in the interplanetary magnetic field (MF). This effect is predicted to be accentuated in the shocked plasma ahead of fast coronal mass ejections (CMESs); its relevance to the internal fields of the ejecta is unclear. CMEs, particularly fast events driving interplanetary shocks, are the cause of almost all large geomagnetic storms near solar maximum. We use a set of CMEs identified by ISEE-3 observations of bidirectional electron streaming, plus IMF and geomagnetic data, to investigate the semiannual geomagnetic variation and its relation to CMEs. We find that the geomagnetic effectiveness of CMEs and post-shock solar wind is well-ordered by speed and by the southward component of the IMF in GSM coordinates, as well as by preexisting geomagnetic conditions. The post-shock seasonal effect, with geomagnetic effectiveness maximizing near April 5 for negative GSEQ By and near October 5 for positive GSEQ By, is identifiable in shock and shock/CME events, but not for CME events without leading shocks. When used to complement the more fundamental causal parameter of CME speed, the seasonal effect appears to have value for prediction of geomagnetic storms. DOE

N92-33899*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PHOTOVOLTAIC ARRAY FOR MARTIAN SURFACE POWER
J. Appelbaum (Tel-Aviv Univ., Israel) and G. A. Landis (Sverdrup Technology, Inc., Brook Park, OH.) Aug. 1992 23 p Proposed for presentation at the 43rd Congress of the International Astronautical Federation, Washington, DC, 28 Aug. - 5 Sep. 1992; sponsored by AIAA, NASA, and NAS
(Contract NAS3-25266; NAGw-2022; RTOP 506-41-11)
(NASA-TM-105827; E-7262; NAS 1.15:105827) Avail: CASI HC A03/MF A01

Missions to Mars will require electric power. A leading candidate for providing power is solar power produced by photovoltaic arrays. To design such a power system, detailed information on solar-radiation availability on the Martian surface is necessary. The variation of the solar radiation on the Martian surface is governed by three factors: (1) variation in Mars-Sun distance; (2) variation in solar zenith angle due to Martian season and time of day; and (3) dust in the Martian atmosphere. A major concern is the dust storms, which occur on both local and global scales. However, there is still appreciable diffuse sunlight available even at high opacity, so that solar array operation is still possible. Typical results

for tracking solar collectors are also shown and compared to the fixed collectors. During the Northern Hemisphere spring and summer the isolation is relatively high, 2-5 kW-hr/sq m-day, due to the low optical depth of the Martian atmosphere. These seasons, totalling a full terrestrial year, are the likely ones during which manned mission will be carried out. Author

N92-33947*# Alabama Univ., Huntsville. Dept. of Mechanical and Aerospace Engineering.
ON THE PHYSICS OF WAVES IN THE SOLAR ATMOSPHERE: WAVE HEATING AND WIND ACCELERATION Annual Report
Z. E. Musielak Aug. 1992 8 p Presented at the AAS Meeting, Atlanta, Jan. 1992 Submitted for publication
(Grant NAG8-839)
(NASA-CR-190806; NAS 1.26:190806) Avail: CASI HC A02/MF A01

In the area of solar physics, new calculations of the acoustic wave energy fluxes generated in the solar convective zone was performed. The original theory developed was corrected by including a new frequency factor describing temporal variations of the turbulent energy spectrum. We have modified the original Stein code by including this new frequency factor, and tested the code extensively. Another possible source of the mechanical energy generated in the solar convective zone is the excitation of magnetic flux tube waves which can carry energy along the tubes far away from the region. The problem as to how efficiently those waves are generated in the Sun was recently solved. The propagation of nonlinear magnetic tube waves in the solar atmosphere was calculated, and mode coupling, shock formation, and heating of the local medium was studied. The wave trapping problems and evaluation of critical frequencies for wave reflection in the solar atmosphere was studied. It was shown that the role played by Alfven waves in the wind accelerations and the coronal hole heating is dominant. Presently, we are performing calculations of wave energy fluxes generated in late-type dwarf stars and studying physical processes responsible for the heating of stellar chromospheres and coronae. In the area of physics of waves, a new analytical approach for studying linear Alfven waves in smoothly nonuniform media was recently developed. This approach is presently being extended to study the propagation of linear and nonlinear magnetohydrodynamic (MHD) waves in stratified, nonisothermal and solar atmosphere. The Lighthill theory of sound generation to nonisothermal media (with a special temperature distribution) was extended. Energy cascade by nonlinear MHD waves and possible chaos driven by these waves are presently considered. I.I.C.

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N92-33526# Los Alamos National Lab., NM.
BDD-I: AN ELECTRON AND PROTON DOSIMETER ON THE GLOBAL POSITIONING SYSTEM
T. E. Cayton, P. R. Higbie, D. M. Drake, R. C. Reedy, R. D. Belian, S. A. Walker, L. K. Cope, E. Noveroske, C. L. Baca, and D. K. McDaniels (Oregon Univ., Eugene.) May 1992 71 p
(Contract W-7405-eng-36)
(DE92-014197; LA-12275) Avail: CASI HC A04/MF A01

The Burst Detection Dosimeter-1 (BDD-1) is a multipurpose silicon detector system that has flown on two spacecraft of the Global Positioning System (GPS) series. This instrument measures the radiation dose received by the GPS spacecraft, primarily from energetic electrons trapped in the Earth's radiation belt, but also from solar energetic particles and galactic cosmic rays outside the trapped radiation zone (when the spacecraft is near the Earth's magnetic poles), because the BDD-1 instrument is a sensitive monitor of the proton flux greater than 50 MeV. Absorbers, located in front of four separate silicon sensors, determine energy thresholds for measuring incident particle fluxes, and the magnitude of energy loss in each sensor provides an imperfect but useful separation between ions and electrons over a wide range of energies. This report describes the important mechanical and electronic features of this detector and includes relations for converting the observed counting rate in the detector to parameters representing the incident flux of charged particles. Combining the system geometry with measured calibrations provides a means of numerically evaluating these parameters. The report presents some sample data measured with BDD-1. DOE

N92-33687# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik.
PRODUCTION OF GAMMA RADIATION IN THE GREAT MAGELLANIC CLOUD Thesis - Technische Univ. [ERZEUGUNG VON GAMMASTRAHLUNG IN DER GROSSEN MAGELLANSCHEN WOLKE]
Gerhard Rank Nov. 1991 120 p In GERMAN
(MPE-230; ETN-92-91909) Copyright Avail: CASI HC A06/MF A02

Theories for the production of continuum gamma radiation by interaction processes in interstellar medium are represented. Measuring data are used for the description of the components of the great Magellanic cloud. The general structure, the distribution of interstellar gas, and the magnetic field are described. A detailed model is calculated for the interstellar photon field of the great Magellanic cloud, whose model encompassed a wavelength field from ultraviolet to radio range. The interstellar electronic spectrum for the cosmic radiation with regard to radio measurement was obtained using a theoretical model. The results of the gamma production model are detailed and compared with corresponding measuring data of the Milky Way. ESA

99 GENERAL

N92-33594# National Science Foundation of US, Tokyo (Japan).
NSF TOKYO REPORTS. JFY 1991 R AND D BUDGET OF THE SCIENCE AND TECHNOLOGY AGENCY (STA)
Jan. 1992 28 p
(PB92-192632; Rept-Memo-223) Avail: CASI HC A03/MF A01

The Japan Fiscal Year 1991 budget for Japan's Science and Technology Agency (STA) amounted to 522,561 million Japanese yen. This represented an increase of 5.6 percent over the previous fiscal year, and accounted for 25.84 percent of the Japanese Government's total research and development (R&D) budget. The monies were used to fund programs in areas of special importance to the government, including the Human Frontier Science Program, fellowships for foreign scientists, special coordination funds for promoting science and technology (S&T), government labs attached to STA, and public corporation research institutes. A detailed explanation of how the budget was allocated is provided. Author

N92-33694# National Aerospace Lab., Amsterdam (Netherlands).
[ACTIVITIES REPORT OF THE NATIONAL AEROSPACE LABORATORY] Annual Report, 1990 [STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM JAARVERSLAG 1990]
31 Dec. 1990 114 p In DUTCH
(ETN-92-92053) Avail: CASI HC A06/MF A02

In the field of flows, research and development activities were carried out in the area of theoretical and numerical methods. In the field of aircraft, the evaluation and certification of the Fokker 50 and Fokker 100 were accomplished. In the field of constructions and materials, research activities were carried out in the areas of aircraft loading, dynamical behavior of constructions, strength and stiffness of contructions, crack growth, composites, fiber reinforced

laminates, aluminum alloys, high temperature materials, corrosion and erosion, and damage assessment. Astronautics research was made in the fields of satellite positioning, heat budget, microgravity, robotics, and remote sensing. Research in the field of computer aided engineering was carried out. ESA

N92-33948*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
RESEARCH AND TECHNOLOGY, 1990
1990 487 p Original contains color illustrations
(NASA-TM-107967; A-91054; NAS 1.15:107967) Avail: CASI HC A21/MF A04; 15 functional color pages

Selected research and technology activities at Ames Research Center, including the Moffett Field site and the Dryden Flight Research Facility, are summarized. These accomplishments exemplify the Center's varied and highly productive research efforts for 1990. The activities addressed are under the directories of: (1) aerospace systems which contains aircraft technology, full-scale aerodynamics research, information sciences, aerospace human factors research, and flight systems and simulation research divisions; (2) Dryden flight research facility which contains research engineering division; (3) aerophysics which contains aerodynamics, fluid dynamics, and thermosciences divisions; and (4) space research which contains advanced life support, space projects, earth system science, life science, and space science divisions, and search for extraterrestrial intelligence and space life sciences payloads offices. I.I.C.

N92-33950*# National Aeronautics and Space Administration, Washington, DC.
SEEDS: A CELEBRATION OF SCIENCE
Bob Melton Aug. 1991 149 p Original contains color illustrations
(NASA-EP-281; NAS 1.19:281) Avail: CASI HC A07/MF A02; 137 functional color pages

The major goal of the project of Space Exposed Experiment Developed for Students (SEEDS) was to stimulate interest in science through the active involvement of all participants. Youthful investigators utilized the basic and integrated science process skills as they conducted the research necessary to complete the data reports used in the compilation of this document. Participants described many unique activities designed to promote critical thinking and problem solving. Seeds made a significant impact toward enhancing the teaching, learning, and enjoyment of science for students worldwide. Author

N92-33976# Washington Univ., Seattle. Nuclear Physics Lab.
[HIGHLIGHTS OF RESEARCH PROJECTS AT THE NUCLEAR PHYSICS LABORATORY OF THE UNIVERSITY OF WASHINGTON] Annual Report, Apr. 1992
1992 106 p
(Contract DE-FG06-90ER-40537)
(DE92-015346; DOE/ER-40537/14) Avail: CASI HC A06/MF A02

This report contains short discussions on topics in the following areas: astrophysics; giant resonances and photonuclear reactions; nucleus-nucleus reactions; fundamental symmetries; accelerator mass spectrometry; medium energy nuclear physics; ultra-relativistic heavy ion collisions; cluster fusion; instrumentation; van de graaff accelerators and ion sources; and computer data acquisition systems. DOE

N92-34075# Los Alamos National Lab., NM.
LABORATORY-DIRECTED RESEARCH AND DEVELOPMENT
Siegfried A. W. Gerstl, comp. and Alixon B. Caughran, comp. May 1992 199 p
(Contract W-7405-eng-36)
(DE92-015649; LA-12319-PR) Avail: CASI HC A09/MF A03

This report summarizes progress from the Laboratory-Directed Research and Development (LDRD) program during fiscal year 1991. In addition to a programmatic and financial overview, the report includes progress reports from 230 individual R&D projects in 9 scientific categories: atomic and molecular physics; biosciences; chemistry; engineering and base technologies; geosciences; space sciences, and astrophysics; materials sciences; mathematics and computational sciences; nuclear and particle physics; and plasmas, fluids, and particle beams. DOE

N92-34085# Brookhaven National Lab., Upton, NY.
NATIONAL SYNCHROTRON LIGHT SOURCE, VOLUME 1 Annual Report, 1991
S. L. Hulbert, ed. and N. M. Lazarz, ed. Apr. 1992 175 p
(Contract DE-AC02-76CH-00016)
(DE92-014910; BNL-52317-Vol-1) Avail: CASI HC A08/MF A02

This report discusses the following research conducted at NSLS: atomic and molecular science; energy dispersive diffraction; lithography, microscopy and tomography; nuclear physics; UV photoemission and surface science; x-ray absorption spectroscopy; x-ray scattering and crystallography; x-ray topography; workshop on surface structure; workshop on electronic and chemical phenomena at surfaces; workshop on imaging; UV FEL machine reviews; VUV machine operations; VUV beamline operations; VUV storage ring parameters; x-ray machine operations; x-ray beamline operations; x-ray storage ring parameters; superconducting x-ray lithography source; SXLS storage ring parameters; the accelerator test facility; proposed UV-FEL user facility at the NSLS; global orbit feedback systems; and NSLS computer system. DOE

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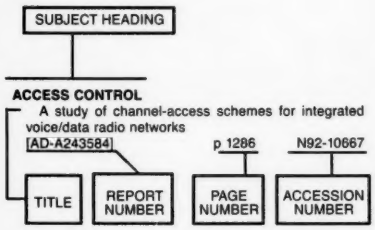

The subject heading is a key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The page number helps you locate the the citation in the abstract section. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus*.

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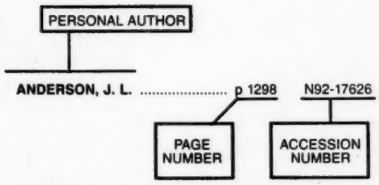

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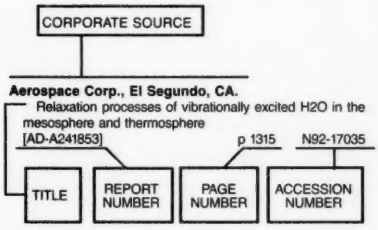

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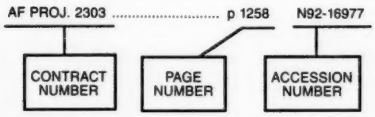

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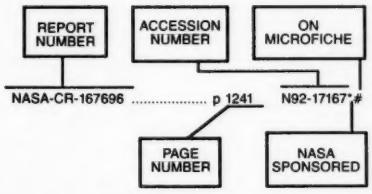

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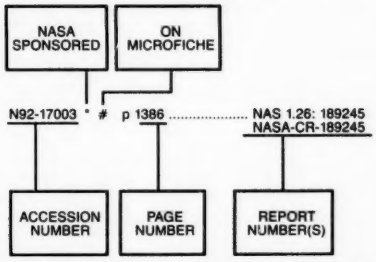

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N92-33528 # p 4232 AD-A252251
N92-33529 # p 4255 AD-A252253
N92-33530 # p 4172 AD-A252363
N92-33531 # p 4238 AD-A252517
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N92-33532 # p 4275 AD-A252519
AFIT/CI/CIA-92-024
N92-33533* # p 4227 NAS 1.15:107661
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N92-33538 # p 4185 AD-A252783

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N92-33540 # p 4120 ... AD-A252786
N92-33541 # p 4173 ... AD-A252814
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N92-33544 # p 4144 ... AD-A252827
AFOSR-92-0669TR
N92-33545 # p 4139 ... AD-A252839
AD-E201068
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N92-33546 # p 4255 ... AD-D015331
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N92-33547 # p 4225 ... AD-D015332
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LA-UR-92-1496
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AD-E201063
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N92-33558 # p 4150 ... AD-A252841
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PL-TR-91-3108-VOL-2
N92-33559 # p 4150 ... AD-A252842
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N92-33560 # p 4168 ... AD-A252932
N92-33561 # p 4275 ... AD-A252935
N92-33562 # p 4247 ... AD-A252936
N92-33563 # p 4216 ... AD-A252938
ARO-28534.1-MA-CF
N92-33564 # p 4177 ... AD-A252950
N92-33565 # p 4227 ... AD-A252953
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N92-33566 # p 4232 ... AD-A252955
ARCCB-TR-92021
N92-33567* # p 4161 ... NAS 1.26:190613
NASA-CR-190613
PSU-TR-92-010
N92-33568* # p 4232 ... NAS 1.26:190631
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N92-33569* # p 4227 ... CSC/TR-90/6155
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N92-33570* # p 4168 ... NAS 1.26:190733
NASA-CR-190733
N92-33571* # p 4236 ... E-7317
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N92-33572* # p 4177 ... ICASE-92-41
NAS 1.26:189696
NASA-CR-189696
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US-PATENT-APPL-SN-558540
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US-PATENT-5,086,329
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N92-33577 p 4190 ... AD-D015321
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N92-33578 # p 4200 ... AD-A253027
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N92-33579 # p 4201 ... AD-A253028
ARO-27859.2-GS-CF-VOL-2
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N92-33581* # p 4108 ... A-90290
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N92-33582 p 4116 ... CA-PATENT-1-268-164
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N92-33583 p 4138 ... CA-PATENT-1-252-194
CTN-91-60142
INT-PATENT-CLASS-H01Q-3/02
INT-PATENT-CLASS-H01Q-3/16
INT-PATENT-CLASS-H01Q-3/18
N92-33584 p 4168 ... CA-PATENT-1-249-644
CTN-91-60146
INT-PATENT-CLASS-H04B-15/00
N92-33585 p 4116 ... CA-PATENT-1-257-618
CTN-91-60166
INT-PATENT-CLASS-B64C-25/60
N92-33586 # p 4196 ... INPE-5360-RPQ/655
N92-33587* # p 4177 ... ICASE-92-29
NAS 1.26:189679
NASA-CR-189679
N92-33588 # p 4220 ... CTN-92-60568
DCIEM-91-70
N92-33589 # p 4181 ... CTN-92-60570
DREO-TN-91-18
N92-33590* # p 4210 ... NAS 1.26:189272
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N92-33591 # p 4265 ... CTN-92-60578
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NRC-34369-PT-3
N92-33592 # p 4265 ... CTN-92-60579
IMI-92RT-23500-1353-G-PT-4
NRC-34370-PT-4
N92-33593* # p 4266 ... NAS 1.26:190690
NASA-CR-190690
N92-33594 # p 4291 ... PB92-192632
REPT-MEMO-223
N92-33595 # p 4266 ... NIST/SP-400/90
PB92-191220
N92-33596 # p 4113 ... AD-A252922
DOT-VNTSC-FAA-92-1
DOT/FAA/AM-92-03
PB92-190032
N92-33597 # p 4266 ... CTN-92-60580
IMI-92RT-23500-1354-G-PT-5
NRC-34371-PT-5
N92-33598 # p 4256 ... CTN-92-60592
N92-33599* # p 4150 ... NAS 1.26:190743
NASA-CR-190743
N92-33600 # p 4191 ... CTN-92-60601
DREA-92-201
N92-33601* # p 4165 ... M-696
NAS 1.60:3282
NASA-TP-3282
N92-33602* # p 4256 ... NAS 1.26:190738
NASA-CR-190738
N92-33603* # p 4154 ... NAS 1.15:103602
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N92-33604* # p 4173 ... NAS 1.26:190815
NASA-CR-190815
N92-33605 # p 4277 ... NO REPORT NUMBER
N92-33606 # p 4168 ... NTIA-92-285
PB92-197193
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NASA-CR-190717
N92-33608 # p 4173 ... NAVSO-P-3676
PB92-183516
N92-33609* # p 4113 ... A-91011
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N92-33610* # p 4177 ... ERC/HSV-TR92-06
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N92-33611* p 4151 ... NASA-CASE-LAR-13388-1
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US-PATENT-CLASS-210-748
US-PATENT-CLASS-210-767
US-PATENT-CLASS-55-15
US-PATENT-CLASS-55-277
US-PATENT-5,147,562
N92-33612* p 4165 ... INT-PATENT-CLASS-B65D-83/10
NASA-CASE-MSC-21776-1
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US-PATENT-CLASS-206-364
US-PATENT-CLASS-206-366
US-PATENT-CLASS-206-370
US-PATENT-CLASS-206-818
US-PATENT-CLASS-220-908
US-PATENT-5,145,063
N92-33613* # p 4145 ... NAS 1.26:189671
NASA-CR-189671
N92-33614* p 4181 INT-PATENT-CLASS-G01K-7/00
INT-PATENT-CLASS-G01K-7/16
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US-PATENT-CLASS-338-22SD
US-PATENT-CLASS-338-25
US-PATENT-CLASS-357-28
US-PATENT-CLASS-374-178
US-PATENT-CLASS-374-185
US-PATENT-5,141,334
N92-33615* # p 4266 ... NAS 1.26:190751
NASA-CR-190751
N92-33616* p 4185 INT-PATENT-CLASS-A47B-97/04
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US-PATENT-CLASS-248-463
US-PATENT-5,149,046
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NASA-TM-4390
N92-33618* # p 4108 ... A-90040
NAS 1.15:102268
NASA-TM-102268
N92-33619* # p 4144 ... NAS 1.26:190821
NASA-CR-190821
N92-33620 # p 4182 ... AD-A253021
N92-33621 # p 4210 ... AD-A253022
N92-33622 # p 4145 ... AD-A253023
N92-33623 # p 4256 ... AD-A253026
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N92-33624 # p 4151 ... AD-A253032
AFOSR-92-0673TR
N92-33625* # p 4109 ... L-16965
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NASA-TP-3221
N92-33626 # p 4183 ... NIFS-133
N92-33627 # p 4190 ... DOT/FAA/CT-TN92/26
N92-33628 # p 4259 ... NIFS-145
N92-33629* # p 4113 ... NAS 1.26:190671
NASA-CR-190671
N92-33630* # p 4223 ... ICASE-92-34
NAS 1.26:189684
NASA-CR-189684
N92-33631* # p 4109 ... L-17046
NAS 1.15:4382
NASA-TM-4382
N92-33632 # p 4253 ... CONF-920315-42
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US-PATENT-CLASS-310-82
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US-PATENT-CLASS-901-23
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US-PATENT-CLASS-901-9
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N92-33636* # p 4159 ... NAS 1.26:184363
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N92-33637 p 4165 ... ETN-92-91988
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N92-33638 # p 4196 ... ETN-92-92025
N92-33639 # p 4236 ... ETN-92-92026
N92-33640 # p 4196 ... ETN-92-92027
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N92-33642 # p 4190 ... ETN-92-92029
N92-33643 # p 4196 ... ETN-92-92030
N92-33644 # p 4204 ... ETN-92-92031
N92-33645 # p 4121 ... ETN-92-92104
N92-33646 # p 4266 ... CTN-92-60574

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N92-33647 # p 4151 ..... ETN-92-92105
N92-33648 # p 4173 ..... ETN-92-92127
N92-33649 # p 4159 ..... CTN-92-60575
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NRC-33744
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N92-33651 # p 4216 ..... ETN-92-92129
N92-33652 # p 4267 ..... CTN-92-60576
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N92-33654 # p 4267 ..... ETN-92-92132
N92-33655 # p 4267 ..... CTN-92-60577
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NASA-CR-4469
N92-33658*# p 4278 ..... NAS 1.26:190855
NASA-CR-190855
N92-33659*# p 4256 ..... NAS 1.26:190823
NASA-CR-190823
N92-33660 # p 4221 ..... CTN-92-60591
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N92-33661*# p 4250 ..... NAS 1.26:190825
NASA-CR-190825
N92-33662 p 4159 ..... ETN-92-91989
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N92-33663 # p 4145 ..... CTN-92-60594
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N92-33664 p 4154 ..... ETN-92-91990
NPL-DMM(A)-63
N92-33665 p 4151 ..... ETN-92-91991
NPL-DMM(A)-64
N92-33666 # p 4145 ..... CTN-92-60595
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N92-33667 p 4151 ..... ETN-92-91992
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N92-33668 # p 4168 ..... CTN-92-60599
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N92-33669*# p 4139 ..... NAS 1.26:184370
NASA-CR-184370
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SAND-92-1271
N92-33672 # p 4161 ..... AD-A252758
BRL-TR-3361
N92-33673 # p 4154 ..... AD-A252761
ARCCB-TR-92019
N92-33674 # p 4276 ..... AD-A252875
N92-33675 # p 4155 ..... AD-A252971
N92-33676 # p 4267 ..... AD-A252877
N92-33677 # p 4204 ..... AD-A252972
N92-33678 # p 4109 ..... AD-A252878
N92-33679 # p 4169 ..... AD-A252880
N92-33680 # p 4253 ..... ANL/CP-75946
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N92-33683 # p 4151 ..... DE92-015100
DOE/ER-13256/6
N92-33684 # p 4160 ..... CONF-920402-37
DE92-016633
SAND-92-8537C
N92-33685 # p 4227 ..... ETN-92-91769
MEMO-INF-91-75
N92-33686 # p 4273 ..... ETN-92-91908
N92-33687 # p 4291 ..... ETN-92-91909
MPE-230
N92-33688 # p 4279 ..... ETN-92-91910
MPE-231
N92-33689 # p 4204 ..... ETN-92-91911
REPT-14
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N92-33692 # p 4196 ..... ETN-92-92033
N92-33693 # p 4114 ..... ETN-92-92034
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N92-33695 # p 4236 ..... AD-A247828
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N92-33697 # p 4169 ..... AD-A250386
N92-33698*# p 4216 ..... NAS 1.26:190575
NASA-CR-190575
N92-33699 # p 4109 ..... BRL-TR-3083
N92-33700 # p 4177 ..... NIFS-123
N92-33701 # p 4238 ..... NIFS-121
N92-33702 # p 4201 ..... AD-A252260
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N92-33703 # p 4267 ..... CNEA-500
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N92-33704*# p 4145 ..... AVSCOM-TR-92-B-009
NAS 1.15:107637
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N92-33705 # p 4247 ..... DE92-015198
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N92-33707*# p 4165 ..... NAS 1.26:189226
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N92-33708*# p 4137 ..... NAS 1.15:107550
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N92-33711 # p 4236 ..... CONF-9206185-1
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N92-33715 # p 4268 ..... ANL/CP-76500
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N92-33716 # p 4160 ..... CTN-92-60573
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N92-33717 # p 4225 ..... CTN-92-60582
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N92-33731 # p 4268 ..... AD-A250887
MCR-92-974-VOL-4
N92-33732 # p 4238 ..... AD-A252419
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N92-33733 # p 4155 ..... CONF-920701-1
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N92-33734*# p 4137 ..... NAS 1.26:189653-VOL-2
NASA-CR-189653-VOL-2
N92-33735 # p 4215 ..... AD-A252398
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N92-33736 # p 4236 ..... AD-A252502
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NASA-TM-107955
N92-33740 # p 4239 ..... IHES/M/91/79
PB92-134394
N92-33741*# p 4204 ..... NAS 1.26:189278
NASA-CR-189278
N92-33742*# p 4236 ..... E-6946
ICOMP-92-09
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N92-33744 # p 4256 ..... ETN-92-91715
N92-33745*# p 4278 ..... NAS 1.26:190618
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N92-33746*# p 4121 ..... AIAA PAPER 92-2699
E-7062
NAS 1.15:105683
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N92-33747*# p 4216 ..... NAS 1.26:190819
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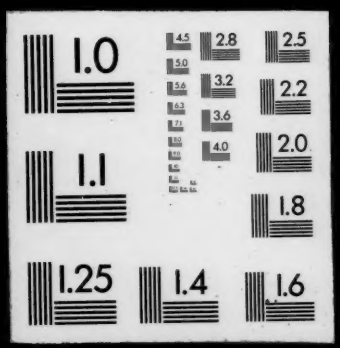
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